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A Preliminary Study of the Genera *Acarospora* and *Pleopsidium* in South America

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ABSTRACT. – Thirteen species of *Acarospora* and *Pleopsidium chlorophanum* are treated from South America. *Acarospora terrigena* from Brazil is described as new to science. A neotype is designated for *Acarospora boliviana*. *Acarospora obnubila* and *A. obpallens* are reported as new to South America.

KEYWORD: Acarosporaceae.

INTRODUCTION

The genus *Acarospora* was erected by Massalongo (1852) with the yellow terricolous *Acarospora schleicheri* (Ach.) A. Massal. as the type of the genus. *Acarospora* is characterized by polyspory, simple, hyaline ascospores, aspicilioid or pseudo-lecanorine apothecia, and bitunicate, but effectively unitunicate, asci with a non-amyloid tholus (Reeb et al 2004; Knudsen 2007). *Acarospora* is a cosmopolitan genus containing approximately 200 saxicolous and terricolous crustose and squamulose species worldwide, which are usually abundant in open, sunny microhabitats. We do not recognize the subgenera of *Phaeothallia* and *Xanthothallia* as representing the true phylogeny of the genus (Reeb et al 2004; Knudsen 2007). The genus is in need of a worldwide revision and, unfortunately, many problems cannot be solved within a regional approach.

The only unified study of the genus in South America was done by Magnusson (1929b) in his global monograph, where he reported nineteen species but did not include either species of *Pleopsidium*, then included in *Acarospora*.

A total of thirty-eight species of *Acarospora* have been described or reported from South America (Aptroot 2002; Calvelo & Liberatore 2002; Feuerer et al. 1998; Feuerer 2007; Galloway & Quilhot 1998; Grassi 1950; Hue 1909; Magnusson 1929a, 1929b, 1947, 1956; Osorio 1972, 1992; Santesson, 1944; Zahlbruckner 1909, 1926). Some of them do not belong to *Acarospora* according to Magnusson (1929b), including *A. plumbeocaesia* Zahlbr. which is an *Aspicilia* with eight spores, *A. skottsbergii* Zahlbr. which is probably a sterile *Buellia*, and *A. subglobsa* (Müll. Arg.) Hue which is a cyanolichen (Galloway & Quilhot 1998). A number of species need detailed investigation in a future study including *A. brasiliensis* Zahlbr., *A. catamarcae* H. Magn., *A. punae* I.M. Lamb, *A. regnelliana* R. Sant., *A. sparsiuscula* H. Magn., *A. theleomma* I.M. Lamb, and *A. trachyticola* (Müll. Arg.) Hue.

Many determinations need to be re-examined. For instance, the report of *A. extenuata* H. Magn. probably refers to *A. boliviana* H. Magn. (Grassi 1950; Calvelo & Liberatore 2002). Although *A. schleicheri* has not been seen from the continent, the species concept *sensu* Weber (1968; Knudsen 2004) has been used and refers to several possible species (Calvelo & Liberatore, 2002; Galloway & Quilhot 1998; Osorio 1972, 1992). *Acarospora mendozana* H. Magn., *A. sanguinascens* Zahlbr. and *A. subcastenaea* (Nyl.) Hue are considered synonyms of *A. bullata* Anzi (Magnusson 1929b, Knudsen 2007),

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A. dissipata H. Magn. is a synonym of *A. chrysops* (Tuck.) H. Magn., and *A. terrestris* (Nyl.) H. Magn. and *A. malmeana* H. Magn. are synonyms of *A. rhabarbarina* Hue, thus reducing the number of actual species reported. At this time it is impossible to say precisely how many species of *Acarospora* occur in South America. We discuss thirteen species of *Acarospora* and *Pleopsidium chlorophanum* in this preliminary study. Further species new to science are expected with *A. oligyrophorica* Aptroot (2002) being the first new *Acarospora* to be described from the continent in the 21st century.

MATERIALS AND METHODS

Valerie Reeb collected *Acarospora* taxa in Bolivia in 2002 and her collections and duplicates (DUKE & LPB) form the basis of our study. The Reeb collections had not been accessioned into LPB at the time paper was written. Additional specimens were supplied by ASU, B, CETC, COLO, DUKE, FH, H-NYL, MSC, NY, S, and UV. Valerie Reeb traveled to Paris Herbarium (PC) in 2006 and obtained from Bruno Dennetière photographs of type material of *A. rhabarbarina*, *A. terrestris*, and *A. xanthophana* (Nyl.) Jatta, which were compared with specimens from H-NYL. Anders Nordin supplied photographs of type material in UPS. The specimens were examined using hand sections and standard light microscopy, in water and 10% solution of KOH, and measured in water. Spot tests were administered. A selection of 47 specimens from South and North America were selected and studied with HPLC by the second author using standard methods (Elix et al. 2003). The descriptions of the species are based on the examination of specimens.

KEY TO SPECIES

This key only applies to species treated in this paper and specimens should be carefully compared against descriptions and if possible authentic specimens as other species are expected to occur in South America. The characters used are average and for instance some effigurate species may lack outer lobes and some species may be broadly attached but appear squamulose through development of lobes in nutrient-rich habitats.

1. Thallus **yellow**.....2
    2. Thallus effigurate.....3
        3. Upper surface rugulose; norstictic acid present.....*Acarospora rouxii*
        3. Upper surface not rugulose; norstictic acid absent.....4
            4. Thallus areolate; apothecia immersed.....*Acarospora boliviana*
            4. Thallus squamulose; apothecia biatorine.....*Pleopsidium chlorophanum*
    2. Thallus not effigurate.....5
        5. On soil.....*Acarospora rhabarbarina*
        5. On rock.....6
            6. Upper surface glossy.....*Acarospora rhabarbarina*
            6. Upper surface dull.....7
                7. Thallus squamulose, with stipe; underside black.....*Acarospora brouardii*
                7. Thallus not squamulose, without a stipe; underside not black.....8
                    8. Areoles with multiple, contiguous apothecia; algal layer interrupted..... *Acarospora xanthophana*
                    8. Areoles without multiple contiguous apothecia; algal layer not interrupted..... *Acarospora chrysops*

1. Thallus **not yellow**.....9
    9. Thallus KC+ red or pink (crystals absent).....10
        10. Thallus effigurate, lacking pits around apothecium.....*Acarospora bullata*
        10. Thallus not effigurate, with pits around apothecium.....*Acarospora obpallens*
    9. Thallus K- or K+ yellow to red (crystals present).....11

11. Norstictic acid present.....*Acarospora lorentzii*
11. Norstictic acid absent.....12

12. On soil.....*Acarospora terrigena*
12. On rock.....13

13. Upper surface white pruinose, spores broadly ellipsoid.....*Acarospora strigata*
13. Upper surface not white pruinose, spores broadly or narrowly ellipsoid.....14

14. Spores broadly ellipsoid (3-7 x 2-3.5 µm).....*Acarospora altoandina*
14. Spores narrow ellipsoid (3-6 x 1.7-2.2 µm).....*Acarospora obnubila*

THE SPECIES

Acarospora altoandina H. Magn., Goteborgs Kungl. Vetensk.- & Vitterhets.-Samhalles Handl., sjatte foljden, ser. B, 6(17): 26-27 (1956).

PLATE 1, FIGURES 1-4.

DESCRIPTION. – Thallus areolate or squamulose, contiguous (in holotype) or dispersed among *Acarospora xanthophana* (in Reeb specimens), often distinctly lobate at margins of contiguous thalli or around some dispersed squamules. Areoles or squamules 0.5-3.0 mm wide, angular to rounded, broadly attached at first, but become distinctly stipitate and squamulose, the lower surface white or darkened by adhering substrate. Upper surface pale to dark brown, matt; well-developed squamules rugulose. Areoles multiplying by division, the stipe splitting and dividing so individual areoles or squamules may contain many individualizing units divided by fissures. Algal layer discontinuous and jagged, up to 200 µm deep, divided by hyphal bands which form prosoplectenchymatous to sub-paraplectenchymatous upper cortex which lacks an epinecral layer or syncortex *sensu* Knudsen (2007). The hyphal bands are responsible for the rugulose upper surface and fissures of future vegetative divisions. Apothecia one or two per areole, squamule or unit (thus many for dividing squamules); disc immersed, pale reddish brown, epruinose, rough and concave, 0.2-1.0 mm wide. Hymenium hyaline, 130-160 µm high. Epihymenium red-brown. Parathecium, 10-50 µm thick, often forming a crown concolorous with the surrounding thallus (in Bolivian specimens but not apparent in holotype), 70-100 µm wide at surface of thallus, narrowing into the hypothecium; hypothecium 15-20 µm thick. Paraphyses ca. 2 µm diam. at mid-level, apices barely expanded in pigment caps, septa not always distinct. Asci 110-125 x 25 µm, narrowly clavate; ascospores about 100 per ascus, broadly ellipsoid, 3-7 x 2-3.5 µm. Spot tests negative. Secondary metabolites absent.

SUBSTRATE AND ECOLOGY. – This species occurs on exposed acidic and volcanic rocks above 3500 meters. In the holotype the thallus is contiguous but in the Bolivian specimens thalli appear to be competing with *A. xanthophana* which stimulates stipe elongation as it does in several other species (such as *A. thamnina* (Tuck.) Herre and *A. obnubila* H. Magn.).

DISTRIBUTION. – The species is currently known only from the mountains of Argentina and Bolivia.

DISCUSSION. – *Acarospora altoandina* is a distinctive South America endemic. The interrupted algal layer is shared with *A. boliviana, A. rouxii* K. Knudsen, Elix & Reeb and *A. xanthophana*. In these specimens, cortical width is often uneven and cortical hyphae vary from prosoplectenchymatous to paraplectenchymatous. The hyphal bands through the algal layer eventually form a rugulose or uneven upper surface. More specimens should be examined to complete a comprehensive revision of this species as specimens used here were small and only photograph of type and protologue were used for determination.

SPECIMENS EXAMINED. – **ARGENTINA**: Jujuy, Casabindo, 3600 m, on stone, *Cabrera* (UPS, holotype, only photographs seen). **BOLIVIA**: Potosi, on S slope of the volcano Tunupa, 19 º 51'38.2" S, 67º 38'13.9" W, 4376 m, on volcanic rock, *Reeb 14-V-02/6* (DUKE); 19º51'39.5" S, 67º38'12.2" W, 4376 m, on volcanic rock, *Reeb 14-V-02/4* (DUKE).

Acarospora boliviana H. Magn., Kungl.-Akad. Handlingar 7, 4: 92 (1929). TYPE: **PERU:** Hochfläche von Ollantaitambo (Urubambatal) bei Cuzco, F. Mattick 701 (B, neotype **designated here**).

PLATE 1, FIGURE 5.

DESCRIPTION. – Thallus effigurate, 2-7 cm wide, orbicular to irregular; confluent thalli without clear center or outer edge; center rimose-areolate in orbicular thalli; areoles angular, 0.2-1 mm wide, less than 1 mm thick, broadly attached to the substrate, the outer areoles usually bilobed, rounded, 0.2-0.5 mm wide. Upper surface yellow, matt to glossy, smooth, but becoming striate, and eventually rugulose. Upper cortex, usually thin (30-40 µm thick) but uneven, cells obscure in water or KOH. Algal layer discontinuous and jagged, divided by hyphal bands. Apothecia usually one to eight per areole towards the center of orbicular thalli; disc immersed, yellow to a pale red-brown, flat, rough, epruinose, 0.1-0.6 mm wide, sometimes with an umbo. Hymenium hyaline, 150-200 µm high. Epihymenium, pale yellow to reddish-yellow. Parathecium narrow to very indistinct. Paraphyses ca. 1.0-1.5 wide at mid-level, apices not expanded, in yellow to reddish pigmented gel. Asci 80-100 x 20-30 µm, clavate; ascospores 100 per ascus, narrow ellipsoid, 4-5 x 2 µm. Spot tests negative. Secondary metabolites: rhizocarpic acid (major), traces of epanorin and conrhizocarpic acid.

SUBSTRATE AND ECOLOGY. – This species occurs on volcanic and acid rocks above 500 m elevation and was reported also from calcareous rock (Magnusson 1929b).

DISTRIBUTION. – The species is currently known from the mountains of Argentina, Bolivia, and Peru.

DISCUSSION. – The holotype of *A. boliviana* (reputedly in PC) collected by Mandon (Magnusson 1929) could not be located and a specimen collected by Mattick is selected as neotype. Our description differs from Magnusson in the observation of an interrupted algal layer.

SPECIMENS EXAMINED. – **ARGENTINA**: Catamarca, Nevados de Auconquija, SE slope of Nevados Pabellón de la Abr a Grande, 4800 m, *Filipovich 5630* (MSC); Jujuy, Tilcara, Pucará de Tilcara, *Krapovickas & Cristóbal* (CTES 18504); de La Rioja: along route 9, ca. 26 km N of Bazan, 28° 59' S, 66° 38' W, c. 550 m, on acidic rock, *Nash 28129* (ASU). **BOLIVIA**: Potosi, Refuge of Andean Animals Eduardo Avaroa, Laguna Colorado, on the rocky slope behind the station, 22°10'39.9" S, 67°49'31.3" W, 4350 m, *Reeb 19-V-02/5 & Reeb 19-V-02/5* (DUKE). **PERU**: Hochfläche von Ollantaitambo (Urubambatal) bei Cuzco, *Mattick 701* (B, neotype).

Acarospora brouardii de Lesd., Lich. Mexique, Suppl. 1, p. 15 (1922).

PLATE 2, FIGURES 6-8.

DESCRIPTION. – Thallus squamulose; squamules dispersed or contiguous and imbricate, up to 4 mm wide, with a black to dark brown stipe, rounded, convex, epruinose. Upper surface dull yellow, smooth to rough; lower surface distinctly carbonized and corticate. Upper cortex prosoplectenchymatous, 60-130 µm thick formed by hyphal bands interrupting the algal layer, cells various from angular to round. Apothecia 1-16 per squamule; disc immersed, yellowish to reddish-brown, punctiform, slit-like or round, epruinose, 0.1-0.4 wide. Hymenium 130-170 µm tall. Epihymenium greenish-yellow. Paraphyses 2.0-2.5 µm diam. at mid-level, apices unexpanded. Parathecium 10-50 µm thick narrowing to 50 µm beneath the subhymenium. Asci 110-130 x 20-24 µm, narrowly clavate. Ascospores 100-200 spores per ascus, broadly ellipsoid, 4-6 x 2-3 µm. Spot tests negative. Secondary metabolites: rhizocarpic acid.

SUBSTRATE AND ECOLOGY. – This species occurs on exposed volcanic and acid rocks; elevational range unknown.

DISTRIBUTION. – *Acarospora brouardii* is known from North America (southern Arizona and Mexico), Argentina (Calvelo & Liberatore 2002, specimen not verified) and Venezuela.

Discussion. – This species can be determined by the large squamules and the black or dark brown lower surface and stipe. In South America it could be confused with well-developed squamules of *A. rhabarbarina* but the latter has a pale or brownish, mineral-stained lower surface and larger discs. In western North America and Mexico this species could be confused with well-developed squamules of *A. socialis* which has a pale lower surface (Knudsen 2007). We have only seen five specimens.

Specimens Examined. – **MEXICO**: Queretaro, Loma al Este, 1950 m, *Arsène 10730* (US, isotype). **VENEZUELA**: Edo Sucre, Parque Nacional Mochima Islas Caracas del Oeste, on unknown rock. *Guariglia 1838* (NY).

Acarospora bullata Anzi, Atti Soc. Ital. Sc. Nat. Milano, 11: 165 (1868). Synonyms: *Acarospora mendozana* H. Magn. (Knudsen 2007), *A. sanguinascens* Zahlbr. (Magnusson 1929b), *A. subcastanea* (Nyl.) Hue (Knudsen 2007).

PLATE 2, FIGURE 9.

Description. – Thallus determinate or rarely indeterminate, orbicular, with effigurate margin, up to 7 cm wide, areolate towards the center. Areoles less than 3 mm wide, the margin with 2-3 rounded lobes per areole, lobes 0.1-0.5 mm wide. Upper surface glossy or dull, varying from pale yellow brown to mahogany with black tones. Upper and lateral cortices paraplectenchymatous, 40-50(-100) µm thick; cells: (3-)5-6 µm wide, sometimes opaque in water; syncortex: sometimes with visible periclinal hyphae, 4-30 µm thick; eucortex: reddish-brown upper layer 5-20 µm thick, lower portion hyaline and 15-40 µm thick. The algal layer is ± even, algal cells ±arranged in vertical columns with strands sometimes extending into medulla. The medulla white, often obscure, intricately prosoplectenchymatous, continuous with attaching hyphae. Apothecia usually one per areole, up to 2 mm across; disc immersed, dark brown to black, flat, rough, epruinose, sometimes with inter-ascal plectenchyma forming surface of minute umbos, sometimes with parathecial crown. Hymenium hyaline, 90-150 µm high. Epihymenium pale to dark brown. Parathecium usually wide, 70-50 µm thick around the disc, often forming parathecial crown, narrowing beneath apothecium. Paraphyses 1.0-2.0 µm wide at mid-level, apices ±expanded to 4-5 µm. Asci 60-100 x 15-28 µm, clavate. Ascospores usually about 100 spores per ascus, usually narrowly ellipsoid but various, mostly 4.0-5.1 x 1.5-2.0 µm**.** Spot tests: cortex KC+ red (a yellowish pigment diffuses from this and several other brown species in K). Secondary metabolites: gyrophoric acid (major), lecanoric acid (minor), ±3-hydroxygyrophoric acid (trace), ±methyl lecanorate (trace).

Substrate And Ecology. – This species occurs on acid and volcanic rocks and can occur on calcareous rock in open situations from above 500 meters**.**

Distribution. – *A. bullata* is known from Argentina and Chile from only historic collections. This widespread species also occurs in Europe, Asia and western North America. It is common in the arid mountains of the inland deserts of western North America.

Discussion. – We use here the broad concept of *A. bullata* used by Magnusson which conflates measurements from European and California specimens (1929b). Claude Roux in reviewing this paper suggested *A. bullata* from Europe may represent a different species from California and South American specimens. At his request we re-examined specimens including the type material of *A. bullata* again. The minutely umbonate disc of European *A. bullata* can be found in some specimens from North and South America and appears to derive from remnants of the cortex dissolved in formation of fertile apothecium. Taxonomic measurements overlapped between specimens from the Americas and Europe. The main difference was that specimens of *A. bullata* from Germany and Italy have a dissected thallus surface which gives them a rugulose look and are sometimes pruinose. Molecular analysis is necessary. If California material, which matches well South American collections, is found to be a different taxon then specimens from North and South America should be called *A. subcastanea.*

In South America *Acarospora bullata* is rarely confused with other species but spot tests with KC/C may be inconclusive in some specimens (e.g. Magnusson 1929b reported *A. mendozana* and *A. subcastanea* to be C-), so TLC should be used.

Specimens Examined. – **ARGENTINA**: Mendoza, in viciniis montis Aconcagua, *Malme* (S, isotype of *A. mendozana*); Mendoza, in viciniis montis Aconcagua, *Malme* (S, as *Lecanora subcastanea*). **CHILE**: Quilmenco, Claude Gay (H-NYL, isotype of *L. subcastanea*).

Acarospora chrysops (Tuck.) H. Magn., Kungl.-Akad. Handlingar 7, 4: 64 (1929). Synonym: *Acarospora dissipata* H. Magn. (Knudsen 2007).

PLATE 3, FIGURES 10-12.

Description. – Thallus of dispersed areoles. Areoles 0.3-1(-2) mm wide, thin, broadly attached, with a thinner rim that can become lobate in nutrient-rich habitats, rarely showing signs of vegetative division. Upper surface yellow, usually matt, sometimes pruinose especially in the center. Upper cortex is paraplectenchymatous, 20-40 µm thick, cells usually obscure, 1-3 µm wide. Algal layer even. Medulla prosoplectenchymatous. Apothecia usually one per areole; disc immersed, sometimes expanding to cover the whole areole or raised above the thallus surface in a parathecial crown concolorous with the thallus; disc dull red to yellowish red, rough, flat, concave or convex, ±with interascal sterile plectenchyma. Hymenium hyaline below but yellowish to reddish brown in the upper part merging into the epihymenium, 70-110 µm tall. Paraphyses 1.5-2.0 µm diam. at mid-level, apices slightly expanded, usually reddish-brown. Asci 55-90 x 15-20 µm, clavate; ascospores 100-200 per ascus, usually narrowly ellipsoid 4-6 x 1.5-2.0(-2.5) µm. Pycnidia globose, 60-100 µm; conidia bacilliform, ca. 2 x 0.6 µm. Spot test negative. Secondary metabolites: Rhizocarpic acid and/or epanorin (major).

Substrate And Ecology. – This species occurs on acid or volcanic rock. In harsh microhabitats the areoles are small and dispersed, but may be crowded and robust with well-developed lobes and large apothecia in nutrient-rich and moist habitats.

Distribution. – In South America *A. chrysops* occurs in Brazil, Columbia, the Galapagos Islands and Venezuela. The species is also known from El Salvador (*Sipman 37851*, B) and Costa Rica (*Sipman 51061*, B) in Central America, Mexico and from Arizona and the Rocky Mountains to the southeastern United States. The species occurs from near sea level on Galapagos Islands to 2250 meters.

Discussion. – *Acarospora chrysops* has a broad distribution. Only the epanorin chemotype appears to occur in the Galapagos Islands but these specimens are morphologically indistinguishable from the rest of the species.

In some cases *A. chrysops* may be difficult to distinguish from *A. rhabarbarina,* but the areoles of the former are generally thinner, broadly attached and more dispersed, the ascospores and paraphyses are narrower, and the algal layer is uninterrupted. The two species are not sympatric in South America.

Specimens Examined. – **BRAZIL**: Rio Grande do Sul, *Malme 767* (S, isotype of *A. dissipata*). **COLUMBIA**: Boyaca, Munic, Sutamarchan, near monastery Ecce Homo, c. 12 km NW of Villa de Leiva, 05°41'N, 73°38'S, 2250 m, on boulders in fields in dry inter-andean valley, *Sipman & Reyes 34321*, *Sipman & Reyes 34306* (B); Narino, Munic. Imues, near El Pedregal, towards Tuquerres, on Pasto-Tumaco road, 1°04'N, 77°28'S, 1880 m, *Sipman, et al. 33539* (B); Huila, E slope of Cordillera Central, 1000 m, on sandstone boulders in pasture, *Aguirre & Sipman 6084* (B). **ECUADOR**: Galapagos Islands: Jervis Island. *Weber L-40100* (COLO); Islas Isabela, NW coast between Punta Albemarle and Volcan, *Weber L-63257* (COLO); Isla Rabida, lava talus slope, east side of island, *Weber L-62863* (COLO). **VENEZUELA**: El Pedregal de Jafí, junto a La Carbonera, 2000 m, Figueiras, *Amann*, *Wirth & Irlet 18168* (NY).

Acarospora lorentzii (Müll. Arg.) Hue, Morph. et Anat., p. 162 (1909).

PLATE 4, FIGURES 13-14.

DESCRIPTION. – Thallus areolate, to several cm wide, indeterminate or determinate and effigurate. Areoles crowded or dispersed, central areoles from 0.5-1.5 mm wide, usually angular, thin and flat to thick and convex, smooth or developing fissures which results in vegetative division; marginal areoles up to 4 mm wide, comprising several lobes up to 1 mm wide, often fan-shaped and fissured; areoles broadly attached, up to 1 mm thick in the center, with a narrow, white, ecorticate, unattached lower surface beneath a down-turned rim that is sometimes blackened. Upper surface epruinose, usually glossy reddish brown, more rarely matt and dark brown; cortical hyphae originating as hyphal bundles which penetrate the algal layer. Upper cortex 50-90 µm thick, cells various, mostly lacking syncortex or epinecral layer. Apothecia rarely numerous and often absent from most of the central areoles, usually one per areole, often expanding and dominating the areole, appearing as innate lecanorine apothecia; disc immersed, dark brown, flat, rough, epruinose, to 0.5 mm wide, the exciple not forming a parathecial crown. Epihymenium 10-15 µm thick, conglutinated in a reddish-brown to yellow pigmented gel. Hymenium hyaline, 90-145 µm high. Paraphyses ca. 2.0 µm in diam. at mid-level, the apices not expanded or caps pigmented. Asci 80-110 x 16-20 µm, clavate; ascospores 100-200 per ascus, narrowly to rarely broadly ellipsoid, 4-5 x 1.8-2.0(-3.0) µm. Pycnidia common, ostioles prominent, brown, often many per areole, to 200 µm deep and 100 µm wide. Conidia bacilliform, 1.5-2.5 x 0.5 µm. Spot tests: cortex K+ yellow turning red, forming crystals (on microscope slide). Secondary metabolites: norstictic acid (major), ±connorstictic acid (minor), ±hyposalazinic acid (trace).

SUBSTRATE AND ECOLOGY. – This species occurs on acid rocks, in open areas at elevations of 600-1500 m.

DISTRIBUTION. – *Acarospora lorentzii* is known from Argentine, Chile, and Uruguay.

DISCUSSION. – *Acarospora lorentzii* can readily be recognized by the high concentrations of norstictic acid present. It is often sterile.

SPECIMENS EXAMINED. – **ARGENTINA**: Buenos Aires, Partido Tornquist, Sierra de la Ventana, 75 km NNE of Bahía Blanca, 38°04' S, 62°00' W, 600 m, on acidic rock, *Nash 23860* (ASU); 30 km W of Olavarria, La China farm house area, 36°40' S, 60°40' W, 150 m, *Nash 26442* (ASU); Catamarca, valley of Rio del Campo, near El Alamito, 1650 m, on granitic rock, *Lamb 5654* (MSC); Mendoza, Campo El Alamo, 20 km E Los Molles, 35°13' S, 69°27' W, *c.* 1500 m, on acidic rock, *Nash 27537* (ASU); Prov. de Rio Negro, Sierra Grande near Ruta 305, 42°10' S, 63°50' W, 80 m, on acidic rock, *Nash 26478* (ASU); San Luis, Sierra del Gigante, 75 km NW of San Luis, 32°40' S, 66°30' W, *c.* 730 m, on acidic rock, *Nash 27610* (ASU). **CHILE**: Santiago, Cerro de Ranca, 1896, *Dusén 79* (S, COLO, isotypes of *A. lorentzii* var. *perfecta* H. Magn.); 8 km west of Tiltil, 1000-13000 m, on porphyry boulders, *Weber & Johnson 84122* (COLO). **URUGUAY**: Lavalleja, *Osorio 3744* (COLO).

Acarospora obnubila H. Magn, Kungl. Vet.-Akad. Handlingar 7, 4: 263 (1929).

PLATE 4, FIGURE 15.

DESCRIPTION. – Thallus areolate to squamulose, dispersed or contiguous when dividing, up to 4 mm in diam. Areoles or squamules, irregular or round, up to 2 mm wide, up to 1-2 mm high, epruinose, becoming fissured and dividing, the rim down-turned or up-turned, quite polymorphous. The stipe can be quite thick and wider than half diameter of squamule, but at that width the squamule usually begins dividing. The upper surface, in a small population, can be very dark blackish-brown to a beautiful light brown. The lower surface is usually white and ecorticate. The cortex is usually ±70 µm thick, with thin syncortex which makes it usually look shiny. The algal layer is usually uneven, penetrated by hyphal bands. Apothecia one to several per areole or squamule, punctiform to 1 mm wide, the disc dark brown to reddish-brown, rough, sometimes pseudo-lecanorine and verruciform. Apothecia often surrounded with thalline

collar. The parathecium is indistinct to 10 µm wide. Hymenium usually 120-170 µm thick. Paraphyses 1-2 µm at base in diam., apices usually more closely septate in upper 30 µm, barely expanded to 2-2.5 µm, usually more closely septate in upper 30µm. Epihymenium reddish-brown, 10 µm thick. Subhymenium 30-50 µm thick. Asci usually clavate, 80-125 x 25-35 µm. Ascospores 100 or more spores per ascus, 3-6 x 1-2 µm, usually narrowly ellipsoid, but quite various in size sometimes. Pycnidia are quite common, globose, 50 x 70 µm; conidia 3.0-4.5 x 1-2 µm. Spot tests negative. Secondary metabolites absent.

Substrate And Ecology. – On sandstone, granite, and volcanic rock, from 500-3708 meters.

Distribution. – In South America *A. obnubila* is known from a single collection from Bolivia. It is known from western North America from California and Arizona. This species could have possibly been reported as *Acarospora smaragdula* sensu Weber (Knudsen 2004).

Discussion. – *Acarospora obnubila* is reported new for South America. It is a non-obligatory juvenile parasite on *Aspicilia* (Knudsen 2007). Some specimens of *Acarospora scabrida* can look similar but have a parathecial crown instead of a thalline collar and an uninterrupted algal layer.

Specimens Examined. – **BOLIVIA**: Potosi: Vinto marble mine, W of Uyunni, S of the Salar, 20°38'15"S, 67°02'34.5"W, 3708 m, on stromatolite, *Reeb 20-V-02/5* (DUKE).

Acarospora obpallens (Nyl. ex Hasse) Zahlbr., Beih. Bot. Centralbl. 13: 161 (1902).

PLATE 4, FIGURE 16.

Description. – Thallus verrucose. Verrucae contiguous to scattered, usually rounded, 0.2-0.7(-2.0) mm wide, rarely more than 0.5 mm thick, broadly attached. Upper surface pale to dark brown with minute sterile pits and non-radial striations around the apothecia. There is usually a single apothecia per verruca. Algal layer is even. Upper cortex paraplectenchymatous, 20-30(-35) µm thick; cells: round to angular, 3-5 µm wide. Apothecia usually one per verruca; disc immersed, dark brown, epruinose, round, to 1 mm wide. Parathecium narrow. Hymenium hyaline, 100-135 µm tall. Epihymenium reddish-brown. Paraphyses ca. 2 µm diam., apices unexpanded but often with pigmented apices. Asci 90-120 x 13-20 µm, clavate; ascospores 100+ per ascus, ellipsoid, 4-5 x 2 µm. Spot tests: cortex KC+ red. Secondary metabolites: gyrophoric acid (major), lecanoric acid (minor), ±3-hydroxygyrophoric acid (trace), ±methyl lecanorate (trace).

Substrate And Ecology. – This species occurs on soil, sandstone, granite, and volcanic rock above 500 meters.

Distribution. – In South America this species occurs in Bolivia and Ecuador. *Acarospora obpallens* is very common in western North America and was originally described from southern California.

Discussion. – This is the first report of *A. obpallens* from South America. The specimen from Ecuador is depauparate.

Specimens Examined. – **BOLIVIA**: Potosi, Salara de Uyuni, Isla Inca Huasi, 3650 m., 20° 14'33.8" S 67°37'39.1"W, on volcanic rock with *Acarospora xanthophana, Reeb VR 11-V-02/3* (DUKE). **EUCADOR**: Cotopaxi, Parque Nacional Cotopaxi, along road from Pampa de Limpios to summit of Cotopaxi, on lava, *R.C. Harris 17425*, *R.C. Harris 17443* (NY).

Acarospora rhabarbarina Hue, Morph. et Anat., p. 117 (1909). *Acarospora rhabarbarina nom. nov. pro Lecanora bella* Nyl. non *Lecanora bella* Ach., Lichenogr. Univ., p. 398 (1810). TYPE: **CHILE**: Quilmenco, *Gay s.n.* (PC [sheet 1], lectotype **designated here**). Synonyms: *Acarospora bella* (Nyl.) Jatta *sensu* Magnusson (1929a & b), *Acarospora malmeana* H. Magn., *Acarospora terrestris* (Nyl.) H. Magn., *Lecanora schleicheri* var. *microcarpa* Nyl. (Knudsen 2007).

PLATE 5, FIGURES 17-21; PLATE 6, FIGURE 22.

DESCRIPTION. – Thallus areolate, verrucose or squamulose. Areoles, verrucae or squamules dispersed or contiguous, 0.5-2.0 mm wide, ca. 0.5-0.7 thick, round and convex to flat and angular, rim down-turned to undulate in some squamules, propagating by vegetative division; broadly attached, areoles in well-developed specimens becoming stiptate and squamulose. Upper surface usually glossy yellow, smooth but becoming fissured, rarely pruinose; syncortex indistinct to 15 µm thick, eucortex 50-130 µm thick. Lower surface corticate, white to yellow or brownish. Algal layer uniform and even or becoming irregular and interrupted by hyphal bundles in well-developed and dividing specimens (Magnusson, 1929a & b; Hue 1909). Apothecia one to three per areole or verruca, but contiguous thalli may comprise multiple units with multiple apothecia, ultimately forming pin-wheel like agglomerations of reduced apothecia (as in type of *A. malmeana)*; disc immersed, deep reddish brown to reddish black (only one specimen seen with pale yellowish apothecia forming pinwheel agglomerations in center), ca. 0.2-0.6 mm in diam., round to rarely slit-like, epruinose, rough. Hymenium 90-110 µm tall, hyaline to pale yellowish. Epihymenium conglutinated in reddish to yellowish brown pigmented gel. Paraphyses ca. 2 µm wide at mid-level, sometimes branching, apices expanded to 3-4 µm. Asci 75-90 x 15-20 µm, clavate; ascospores 100-200 per ascus, broadly ellipsoid, 4-6 x 2-3 µm. Spot tests negative. Secondary metabolites: epanorin (major or trace), and/or rhizocarpic acid (major or trace), ±conepanorin (minor), ±conrhizocarpic acid (minor), ±vulpinic acid (trace). The two chemotypes do not appear to exhibit any differences in geographical distribution, substrate preference or morphological expression.

SUBSTRATE AND ECOLOGY. – This species occurs on exposed volcanic and acidic rocks and adjacent soil above 900 meters elevation.

DISTRIBUTION. – In South America *A. rhabarbarina* is known from Argentina, Bolivia, Chile, and Peru while in North America it is rare in Arizona and California.

DISCUSSION. – This species is widely distributed in the mountains of South America. Magnusson (1929) distinguished *A. malmeana* from other taxa by its multiple apothecia distributed in a wheel-like formation, but such specimens clearly intergrades with others having few or a single apothecium per areole (as in *Nash 23897*, ASU) from same province and area as the type of *A. malmeana*). Thus this character is definitely not valuable, and specimens of *A. rhabarbarina* exhibit considerable variability. The type of *A. terrestris* (Nyl.) H. Magn. is sterile, but often sterile and fertile specimens occur side by side on both rock and soil (as in *Weber & Johnston L-64272* and *L-64273*, COLO), and *A. terrestris* is a further synonym of *A. rhabarbarina.* The type of *A. chilensis* H. Magn. has apparently been lost, but based on its description (Magnusson 1929b), we suspect that it too represents a morphotype of *A. rhabarbarina.*

Some specimens of *A. rhabarbarina* eventually develop a stipe and become squamulose, appearing superficially similar to *A. socialis* H. Magn., a common species in southwestern North America. However, *A. socialis* does not occur in South America, with the previously reported specimen (Magnusson 1929b) being a mis-determination of *A. rhabarbarina. Acarospora socialis* differs in lacking the reddish brown epihymenium and the interrupted algal layer. Nevertheless the distinction of these two species should be confirmed using molecular methods.

The original specimens of this species in PC were first described as *Lecanora bella* by Nylander, but this name was an illegitimate homonym of *Lecanora bella* Ach. Nylander subsequently renamed the species *Lecanora xanthophana* and listed a new type. Apparently Jatta thought the Nylander names applied to two different species and transferred both to *Acarospora* without explanation. While both Hue and Magnusson agreed with his new combination of *xanthophana,* Hue did not accept the *bella* combination. Magnusson later accepted it, but admitted he never examined the specimen which Jatta applied the combination to and had a question mark behind his combination (Magnusson 1929b). Hue recognized that

Lecanora bella and *Lecanora xanthophana* were distinct species and described the original specimen of *Lecanora bella* Nyl. in PC as *Acarospora rhabarbarina.* We accept Hue's name and a lectotype is selected here.

Specimens Examined. – **ARGENTINA**: Buenos Aires, Sierra de la Ventana, Cerro Ceferino, sobre rocas en la cumber, 100 m, *Osorio 7110* (COLO); Catamarca,19 km E Villa Mazan near border with La Rioja, 28°41'S, 66°22'W, c. 900 m, on acidic rock, *Nash 28123* (ASU); Andalgalá, Cuesta de Las Chilcas, near Camp de Pucará, 1920 m, on metamorphic rock, *Lamb 5755* (MSC); Chubut, 14 km E of Pampa de Agoria along Route 25 at turnoff to Colon Conhue, 43°44'S, 69°27'W, 600 m, on acidic rock, *Nash 26562* (ASU); Mendoza, ïn viciniis montis Aconcagua, Puenta del Inca, Malme 1903 (S, isotype of *A. malmeana*); Partido de Las Heras, 10 km SSE of Cerro Aconcagua, 32°48'S, 69°48'W, c. 900 m, on acidic rock, *Nash 23897* (ASU); along route 220 N of San Carlos and 17 km W of El Sosneado, 34°57'S, 69°50'W, c. 1700 m, on acidic rock, *Nash 27560* (ASU); Tucumán, Tapi, Apoima, on rock, *Culberson 14847*, *Culberson 14848* (DUKE). **BOLIVIA**: on soil, *Mandon s.n.* (H-NYL 3441); Chuquisaca, Camargo area, 20°39'07.1"S, 65°11'37.2"W, 2569 m, on sandstone, *Reeb 24-V-02/3* (DUKE); Potosi, Salar de Uyuni, Isla Inca Huasi, 20°14'26.9"S, 67°37'27.2"W, 3650 m, on volcanic rock, *Reeb 12-V-02/5* (DUKE); on the east slope of the volcano Ollaque, close to the minor trail at the level of the shed, 21°17'58.5"S, 68°09'42.9"W, 4930 m, on soft consolidated soil in a slide of volcanic rocks more or less stable, *Reeb 17-V-02/2* (DUKE); Sierra de Rosas, *Mandon* (H-NYL 24936); **CHILE:** Aconcagna, *Follmann 12483* (B); Aconcagua, Cuesta de Chacabuco, *Mattick 259a* (B); Coquimbo, al S de Loa Vilos, Punta Quelén, 10 m, on soil, *Follmann 35061* (B); Coquimbo, *Gay* (H-NYL 3440, determined by Nylander as *Lecanora schleicheri* var. *microcapa* Nyl.); Coquimbo, *Skottsberg s.n.* (S); Concepcion, volcanic rock, *Thaxter* (FH, S); Macama, Les Bombes, *Follmann 14762* (B); Santiago, *Follmann 12296* (B); Santiago, Cerro de Ranca, *Dunsen 85* (COLO); Santiago, 8 km west of Tiltil, on east slope of Cuesta de la Dormida, 1000-1003 m, on porphyry boulder in sun, *Weber & Johnston L-64125* (COLO); NW of Santiago at junction of Caleu and Rungue roads, north of Tiltill, 700 m, on soil and rock or vertical road-cuts *Weber & Johnston L-64272*, *Weber & Johnston L-64273* (COLO); Valparaiso, Cuesta la Dormida, 1300 m, *Mattick 222*, *Mattick 224* (B); **PERU:** Ica, western foothills of Andes 36-40 km E of Nazca on road to Puquio, rhylolite, 2000-2250 m, *Weber & Kohn, L-66453* (COLO); Puno, San Roman, Juliaca, on soil, *Williams 2676* (NY, p.p. w/ *A. xanthophana*).

Acarospora rouxii K. Knudsen, Elix & Reeb, *in* Nash et al. Lich. Flora of Greater Sonoran Region, 3: 26-2. 2007.

PLATE 6, FIGURE 23.

Description. – Thallus areolate, effigurate or indeterminate to 6 cm wide. Areoles usually contiguous, flat and smooth at first, mostly angular, 1-5 mm wide, but becoming convex, verruculose and rugulose, to 1.5 mm thick in thallus center; in effigurate thalli the outer areoles usually have two short, narrow lobes per areole. Upper surface dull yellow, subdivided by shallow cross-hatching, epruinose, rough with a papillate texture. Upper cortex paraplectenchymatous to subprosoplectenchymatous, 50-100 µm thick, with uneven, obscured hyphae in water or K; syncortex: not evident to thin but indistinct. Algal layer jagged, interrupted by hyphal bands. Apothecia one to five per areole; disc immersed, reddish brown to yellow, less than 0.5 mm wide, sometimes with umbos or ridges of sterile plectenchyma. Parathecium narrow, rarely expanding around disc to form a parathecial crown. Hymenium hyaline to pale yellow, 100-170 µm tall. Epihymenium usually granulose, reddish brown. Paraphyses 1.5-2 µm diam. at mid-level, apices unexpanded or barely expanded. Asci 80-135 x 20-25 µm, clavate; ascospores 100+ spores ascus, broadly ellipsoid, 3-5 x 1.5-2.5 µm. Spot tests: medulla K+ yellow turning red, forming crystals (visible in mounted section). Secondary metabolites: norstictic acid (major), rhizocarpic acid (minor), ±connorstictic acid (trace), ±gyrophoric acid (trace), ±epanorin (trace).

Substrate And Ecology. – This species occurs on exposed volcanic or acidic rocks above 3000 m.

Distribution. – In South America this species is known from Bolivia, Chile and Peru. Also known from Mexico and Arizona (where it occurs above 1900 m).

Discussion. – In South America *A. rouxii* can readily be distinguished by its yellow rugulose thallus containing high concentrations of norstictic acid.

Specimens Examined. – **ARGENTINA**: San Luis, Sierra del Gigante, 75 km NW of San Luis, on acidic rock, *Nash 27611* (ASU). **BOLIVIA**: Potosi, on the south slope of the volcano Tunupa, at the level of the second crater starting from Coquesa, 19°50'36.7"S, 67°38'28.5"W, 4920 m, *Reeb 13-V-02/5* (DUKE). **CHILE:** Coquimbo, along the road from Illapel to Coquimbo, *Johnson s.n.* (NY). **PERU**: Junin, Province of Yauli, District of Huay, surroundings of Andaychagua mining unit (Volcan Mining Company), 11°35'S, 75°52'W, 4700-4900 m, mats with *Stipa ichu* and other grasses and exposed rock surfaces and granitic boulders, *Rivas-Plata 304 & Lücking* (F).

Acarospora strigata (Nyl.) Jatta, Malpighia, 20: 10 (1906).

PLATE 6, FIGURE 24.

Description. – Thallus areolate or verrucose, to 2 cm wide. Areoles or verrucae dispersed to contiguous, convex, usually pruinose and fissured, 0.2-05 mm wide in South American specimens, but up to 3 mm wide in western North American specimens. Upper surface brown beneath pruina. Algal layer ±continuous, depending upon the expanding apothecium. Upper cortex paraplectenchymatous, 45-165 µm thick; cells: 2-3(-5) µm wide; syncortex: (10-)40-50(-100) µm thick, with hyphal cells sometimes visible, sometimes splitting down to eucortex, often in cross-hatch pattern; eucortex: sometimes inspersed, upper layer often with a distinct horizontal reddish line in cross section, 10-15 µm thick; lower layer hyaline and 15-50 µm thick (increasing in thickness with size of areoles); Apothecia usually one per areole; disc blackish to a reddish brown, ±pruinose, rough, to 1 mm wide. Hymenium hyaline, 100-110 (-170) µm tall. Epihymenium brown. Paraphyses 1-2 µm wide, apices not expanded but pigmented brown. Asci 80-120 x 17-27 µm, clavate; ascospores mostly 100 per ascus, broadly ellipsoid, 3-7 x 2-4 µm. Spot test negative. Secondary metabolites: none detected.

Substrate And Ecology. – This species occurs on calcareous and acid rocks in exposed, arid locations above 300 meters.

Distribution. – In South America, *A. strigata* is only known from historic collections from Argentina (Magnussson 1929b) and Chile. Its center of distribution appears to be in western North America (Knudsen 2007), but it is also known from Asia (Magnusson 1944).

Discussion. – This species is characterized by the usually pruinose areoles, the broad ascospores and the negative spot tests.

Specimen Examined. – **CHILE**: Coquimbo, on calcareous rock, *Gay* (H-NYL 24877, H-NYL 24898, H-NYL 3317).

Acarospora terrigena K. Knudsen, Elix & Reeb, **sp. nov.**
Mycobank#511451

PLATE 7, FIGURE 25.

Thallus areolatus, fuscus et terrestris. Areolae contiguae, adnatae, 0.2-1 mm latae. Apothecia immersa et haematrista, 0.1-0.5 lata. Rhizohyphae elongatae. Substantia nulla diagnostice.

TYPE: BRAZIL: Rio Grande do Sul, Porto Alegre, 1892, *Malme s.n.* (S, holotype; COLO, isotype) Further isotypes may be deposited in other European herbaria.

Description. – Thallus terricolous, areolate, to 5+ cm wide. Areoles contiguous, 0.3-0.5(-1.0) mm wide, round to angular, separated by deep cracks, subdividing vegetatively. Upper surface yellow-brown,

epruinose, smooth; upper cortex elevated in the center beneath the swelling ascomata and distinguished by a reddish brown color darker than the rest of the areole, thin, to 30 µm thick, with an epinecral layer. Lower surface narrow, ecorticate and stained by the substrate. Apothecia one per areole but subdividing areoles may have 5-6 per areole, with a distinct rim, the rim flat to undulate or down-turned, often pigmented a darker brown; disc reddish brown, not immersed, 0.1-0.3 mm wide, flat, epruinose, ±smooth. Algal layer even, 100-200 µm thick. Medulla prosoplectenchymatous, not clearly delineated and mixed with substrate granules and gelatinized hyphae. Parathecium thin, prosoplectenchymous, 50-60 µm thick, pigmented deep red near the surface. Hymenium hyaline, *c.* 200 µm tall. Epihymenium reddish brown, 10-20 µm thick. Paraphyses ca. 1 µm wide at mid-level, not clearly septate, with unexpanded apices, sometimes with reddish-brown caps. Asci are 150-160 x 20-30 µm, narrowly clavate to obclavate; ascospores 100-200 per ascus, broadly to narrowly ellipsoid, 4-7 x 1.5-2.5 µm. No pycnidia seen. Spot tests negative. No secondary metabolites detected by TLC and HPLC.

Substrate And Ecology. – This species is terricolous on alluvial delta soil.

Distribution. – Known only from the type collection from Porto Alegre, Rio Grande do Sul in southern Brazil.

Discussion. – Porto Alegre is a delta formed of alluvial soils deposited at the confluence of five rivers. The area is subtropical with regular precipitation throughout the year and regular radiant fogs and high humidity in the summer. The area has been heavily developed since the type collection was made in 1892. If the species is narrowly endemic to the delta area of the state of Rio Grande do Sul, it may well have been extirpated from most of its original range or is possibly extinct.

Though some characters of *A. terrigena* are similar to that of the *A. smaragdula* group, it differs in having an epinecral upper surface and a continuous algal layer. The thallus of *A. terrigena* is very similar to that of *A. dispersa* H. Magn. from North America (Knudsen 2007). Magnusson (1929b) considered the single specimen of *A. terrigena* (r) that he examined was a poorly developed morphotype of *A. terricola* H. Magn. However, *A. terricola* is distinguished by its dark brown upper surface, punctiform apothecia, and the areoles which arise from anastomosing rhizohyphae rather than vegetative subdivision (Knudsen 2007).

Like other terricolous *Acarospora* species, including *A. brattiae* K. Knudsen, *A. nodulosa* (Duf.) Hue, *A. schleicheri* (Ach.) A. Massal., as well as *A. terricola, A. terrigena* has well-developed rhizohyphae and pseudorhizines.

Acarospora xanthophana (Nyl.) Jatta, Malpighia 20: 1-10 (1906).

PLATE 7, FIGURES 26-28.

Description. – Thallus areolate to subsquamulose, dispersed or contiguous, to 4 cm wide. Areoles irregular to sublobate, 0.5-2.0 mm wide, 0.5-1.5 mm thick, subdividing vegetatively, broadly attached, becoming elevated; underside of the down-turned or lobed rim narrow, usually whitish. Upper surface yellow, dull, smooth but becoming cracked or fissured, often rugulose, epruinose. Upper cortex varying thickness, from very narrow to 30-100 µm, with distinct upper syncortex, hyphae obscure in water or KOH, paraplectenchymatous to prosoplenthenchyamatous, cells various Algal layer interrupted by broad hyphal bands in thick specimens. Apothecia many per areole; disc punctiform, yellow to brown, 0.1-0.4 mm wide, sometimes surrounded by a slightly elevated parathecial crown concolorous with the thallus. Hymenium 130-200 µm high, the upper portion yellowish, the lower hyaline. Epihymenium yellow. Paraphyses slender, ca. 1.5 µm diam. at mid-level, apices not expanded. Asci 100-140 x 15-25 µm, narrowly clavate; ascospores 100-200 per ascus, narrowly ellipsoid, 3-5 x 1.5-2 µm. Pycnidia abundant; conidia ellipsoid, ca. 2 x 1.5 µm. Spot tests negative. Secondary metabolites: epanorin (major or minor or trace) and/or rhizocarpic acid (major or minor), sometimes traces of conepanorin.

Substrate And Ecology. – Usually this species is found on exposed volcanic and acid rocks above 2000 meters elevation. It also occurs near sea level on Isla Más a Tierra, Juan Fernandez Islands.

Distribution. – *Acarospora xanthophana* is known from Argentina, Bolivia, Chile, and Peru.

Discussion. – *Acarospora xanthophana* appears to be endemic to the mountains of South America above 2000 meters.

Specimens Examined. – **ARGENTINA**: Jujuy, Moreno, 3800 m, *Fries s.n.* (colo). **BOLIVIA**: Larecaja, Viciniis Sorata, Tecacirca, supra Choquecoa pr. Los Aruncheras, cerro de Rosas, *Mandon* (h-nyl 24943, isotype); Potosoi, at the foot of the volcano Tunupa, W of the village of Coquesa, along the Salar of Uyuni, 19°54'10.5"S, 67°38'29.8"W, 3690 m, on volcanic rock, *Reeb 15-V-02/3* (duke); Refuge of Andean Animals Eduardo Avaroa, Laguna Colorado, on the rocky slope behind the station, 22°10'39.9"S, 67°49'31.3"W, 4350 m, on volcanic rock, *Reeb 19-V-02/5* (duke); on the road from Uyuni to Potosi, between Ollerias and Ticatica, 20°14'28.5"S, 66°25'24.6"W, 3800 m, on sandstone, *Reeb 21-V-02/1* (duke); Salar de Uyuni, Isla Inca Huasi, 20°14'36.2"S, 67°37'38.2"W, 3650 m, on cement of conglomerate, *Reeb 11-V-02/9* (duke); 20°14'26.9"S, 67°37'27.2"W 3650 m, *Reeb 17-V-02/7* (duke). **CHILE**: Cordillera de los Patos, *Gay* (h-nyl); Iquique, Isulaga National Park, Enquelga, 19°15'S, 68°43'W, 3690 m, *Quilhot 1471* (uv); Juan Fernandez Islands, Isla Más a Tierra, Puerto Frances, Valley, sea level, *Imshaug 38006* (fh); Puerto Ingles, rocky shore at landing place at end of the bay, sea level, *Imshaug 37881* (msc); Santa Clara Island, El Morro del Spartán, 10 m, *Imshaug 38218-A* (msc); Loa, above Puritana, 4000 m, Follmann 34408 (b); Lquique: Mountain ridge above Mamina, 3200 m, *Follmann 34409* (b); Museum Botanicum Berolinense, El Tarapaca, precordillera NE of Mamina, 2900 m, *Follmann 34353* (b); NE of Mamina, 2500 m, *Follmann 34224* (b); PERU: volcano of Misti, near Arequipa, 4389 m, *Bailey s.n.* (fh).

Pleopsidium chlorophanum (Wahlenb.) Zopf, Ann. Chem., 284: 117 (1895).

Illustrations: see Wirth p. 751 (1995); Bulletin of the California Lichen Society 12:1 (2005), back cover, http://californialichens.org/bulletin/index.html

Description. – Thallus areolate or squamulose, orbicular, up to 2 cm wide, the margin ±distinctly effigurate. Areoles or squamules to 3 mm wide, marginal lobes poorly developed, 0.5-1(-2) mm long, up to 1 mm thick. Upper surface yellow-orange, epruinose. Upper cortex 40-60 µm, cells various. Algal layer even. Apothecia numerous, usually one per areole, 1-3 mm wide; disc pale yellow, lecanorine, flat, becoming convex and the margin excluded, biatorine. Parathecium 50-80 µm thick, narrowing in hypothecium. Hymenium hyaline, 50-70 µm high. Epihymenium yellow-brown. Paraphyses ca. 2 µm wide at mid-level, apices barely expanded. Asci 70-80 x 15-20 µm, clavate; ascospores 100-200 per ascus, hyaline, simple, ellipsoid, 3.5-4.5 x 1.5-2 µm. Pycnidia immersed; conidia, ellipsoid, 3-4 x 1.5-2 µm. Spot tests negative. Secondary metabolites: rhizocarpic acid (major), acaranoic acid (minor), and acarenoic acid (minor).

Distribution. – In South America this species is known from Argentina. It also occurs in Antarctica, Asia, Europe and North America.

Discussion. – This distinctive species is characterized by its yellow apothecia with thalline margin finally excluded, and squamulose thallus.

Specimens Examined. – **Argentina**: Provincía de De Neuquen: Partido de Collon Cura, 11 km NE of the junction of routes 40 & 237 along route 237, 40°24'S, 70°31'W, 880 m, on acidic rock, *Nash 24156, Nash 24157* (asu).

CONCLUSION

Thirteen species of *Acarospora* and one of *Pleopsidium* are discussed in this paper but it is obvious that further work is needed to complete a comprehensive revision of Acarosporaceae in South America. Older literature records need to be revisited and more specimens need to be examined. A number of type specimens were not examined during this study including *A. brasiliensis* Zahlbr., *A. catamarcae* H. Magn., *A. punae* I.M. Lamb, *A. regnelliana* R. Sant., *A. sparsiuscula* H. Magn., *A. trachyticola* (Müll. Arg.) Hue, and *A. theleomma* I.M. Lamb. These species are in need of detailed study and taxonomic assessment. More extensive collecting is obviously needed.

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Plate 1. Figures 1-2, *Acarospora altoandina*, holotype (*Cabrera s.n.*, UPS), images by A. Nordin. **Figures 3-4**, *A. altoandina* (*Reeb 14-V-02/4*, DUKE), images by J. Good. **Figure 5**, *A. boliviana*, netotype (*Mattick 701*, B), image by J. Good.

Plate 2. Figures 6-8, *Acarospora brouardii*, isotype (*Arsène 10730*, US), images by J. Good. **Figure 9**, *A. bullata* (*Knudsen 3351*, UCR), image by J. Good.

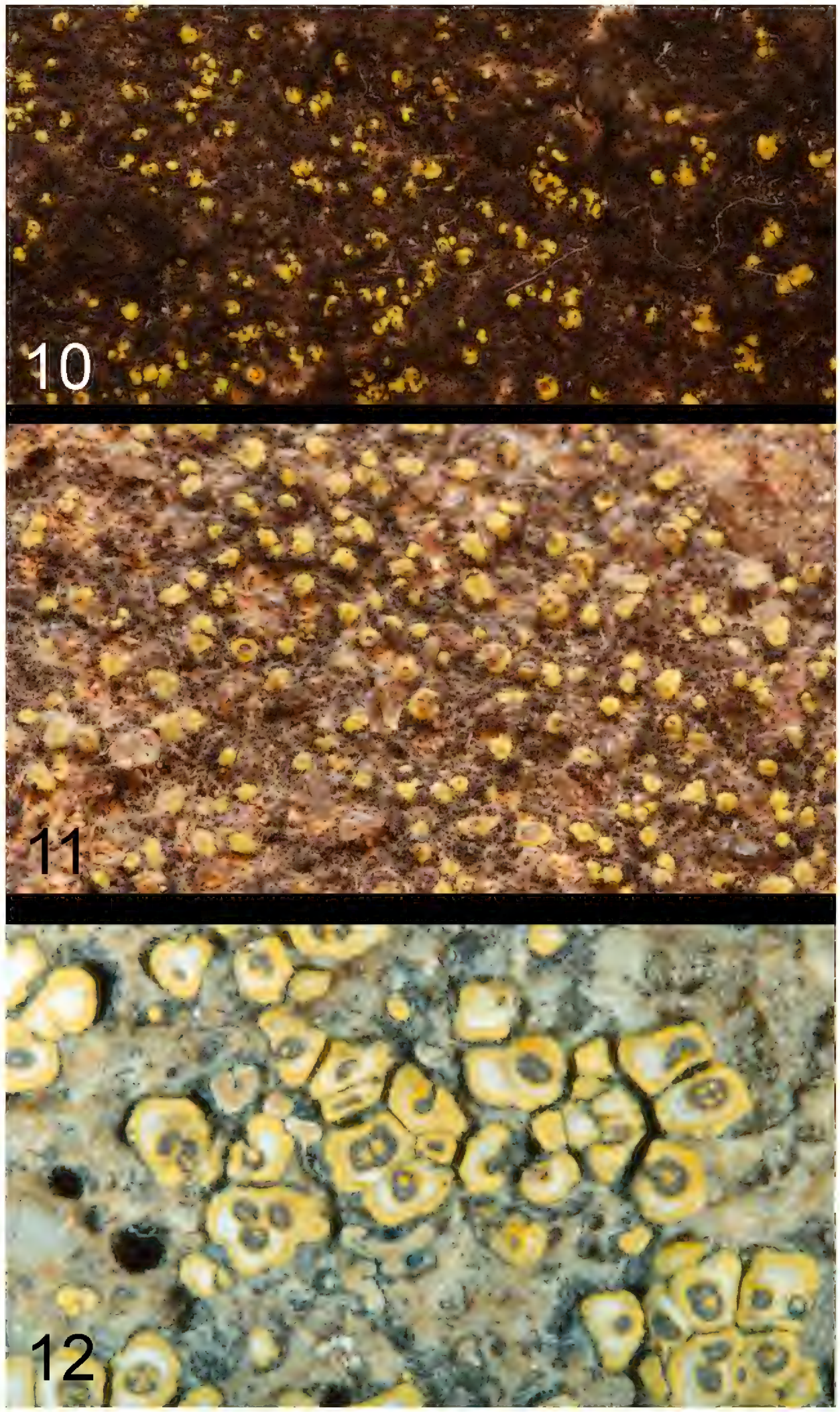
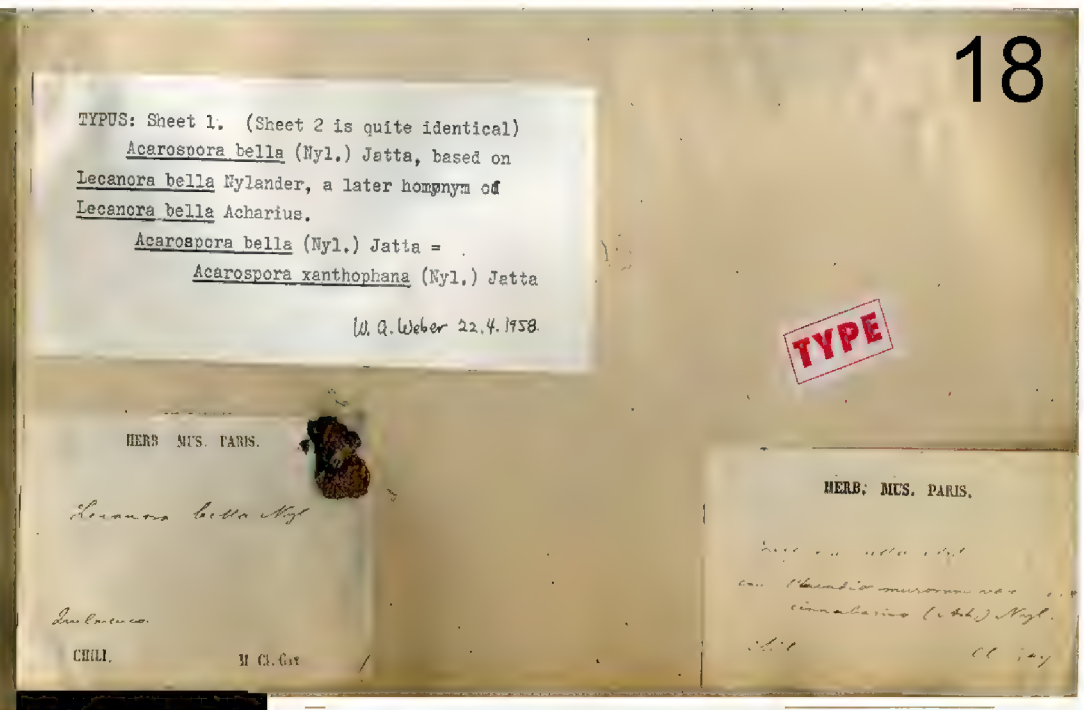


Plate 3. Figure 10, *Acarospora chrysops*, isotype of *A. dissipata* (*Malme 767*, S), image by J. Good. **Figure 11**, *A. chrysops*, lectotype (*Ravenel 424*, FH), image by J. Good. **Figure 12**, *A. chrysops* (*Weber L-62863*, COLO), image by J. Good.

Plate 4. Figure 13, *Acarospora lorentzii*, (*Nash 27610*, ASU), image by J. Good. **Figure 14**, *A. lorentzii*, (*Osorio 3744,* COLO), image by J. Good. **Figure 15**, *A. obnublia* (*Knudsen 5426*, COLO), image by J. Good. **Figure 16**, *A. obpallens* (field image from Santa Ana Mountains, Orange Co., CA), image by R. Muertter.



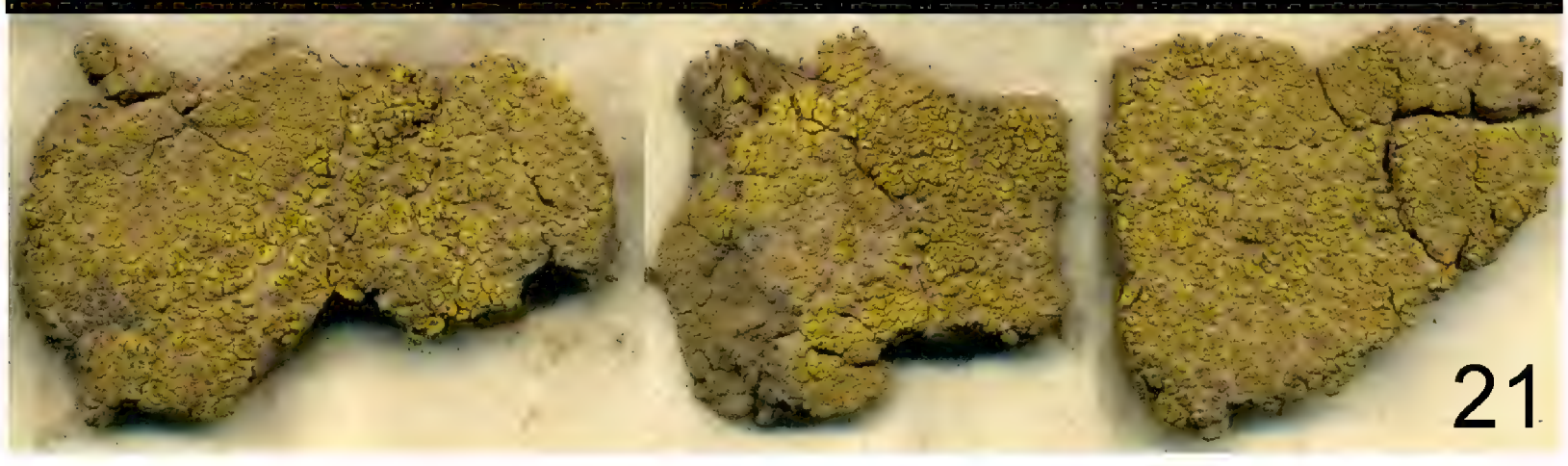


Plate 5. Figures 17-18, *Acarospora rhabarbarina*, lectotype (*Gay s.n.*, PC), image by staff of PC. **Figure 19**, *A. rhabarbarina*, holotype of *A. malmeana* (*Malme 1903,* S), image by R. Schröder. **Figures 20-21**, *A. rhabarbarina*, holotype of *A. terrestris* (*Mandon 1790bis*, PC), images by staff of PC.

Plate 6. Figure 22, *Acarospora rhabarbarina*, (*Weber L-64125*, COLO), image by J. Good. **Figure 23**, *A. rouxii*, (*Reeb 13-V-02-5,* DUKE), image by J. Good. **Figure 24**, *A. strigata*, (*Knudsen 2638*, UCR), image by J. Good.

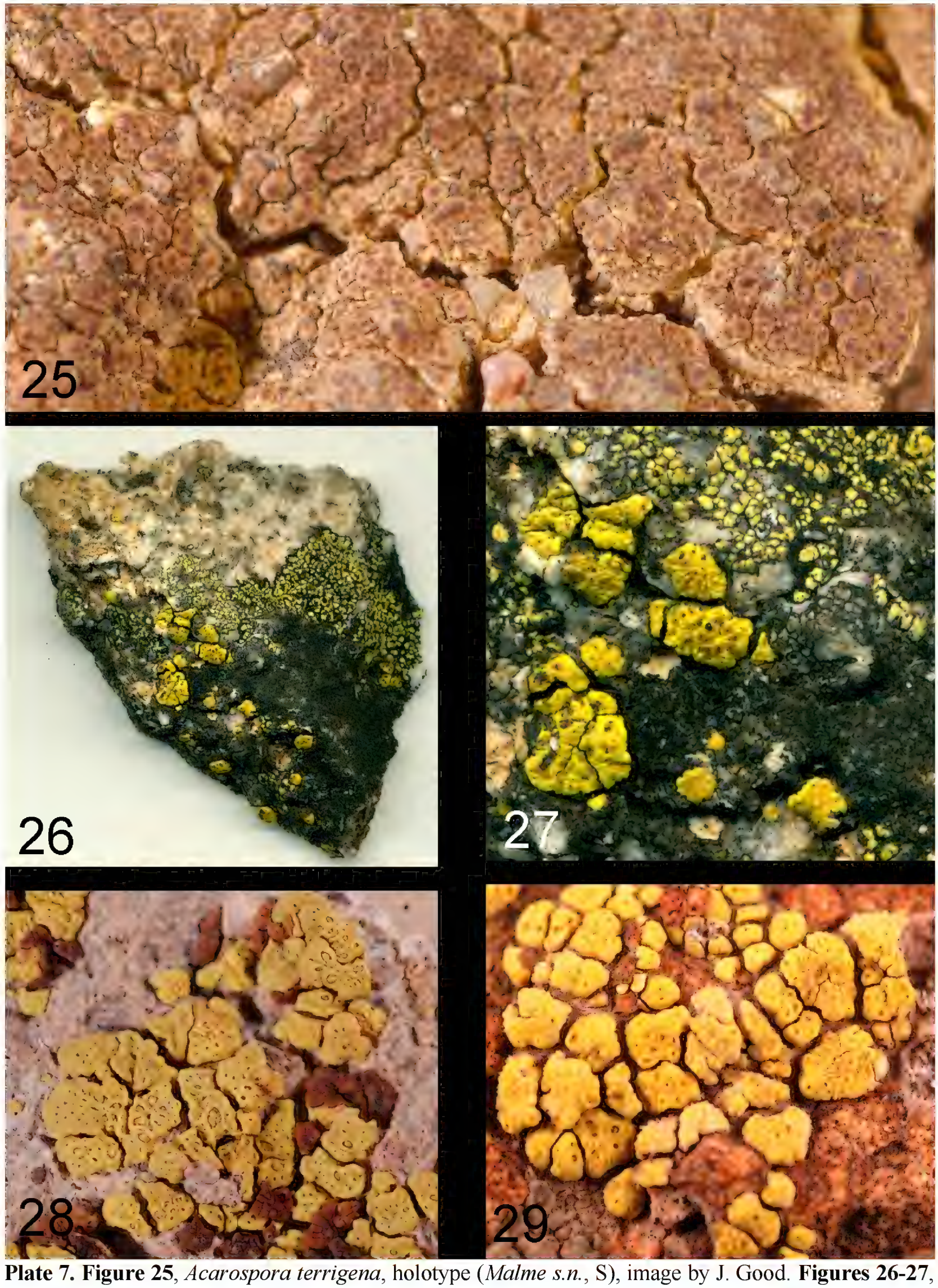


Plate 7. Figure 25, *Acarospora terrigena*, holotype (*Malme s.n.*, S), image by J. Good. **Figures 26-27**, *A. xanthophana*, holotype (*Mandon s.n.,* PC), image by staff of PC. **Figure 28**, *A. xanthophana*, (*Reeb 4-V-02*, DUKE), image by J. Good. **Figure 29**, *A. xanthophana*, (*Follmann 34224*, B), image by J. Good.

Opuscula Philolichenum, **5**: 23-24. 2008.

Micarea perparvula in North America

Brian J. Coppins[1]

ABSTRACT. – *Micarea perparvula* is formally reported for North America, from New Jersey and Louisiana.

The name *Lecidea perparvula* Nyl. was overlooked during my revision of European *Micarea* (Coppins 1983) but was drawn to my attention by Christian Printzen while he was preparing his revision of European *Biatora*. The name was found to refer to a hitherto unrecognized species of *Micarea*. I have yet to see further collections from Europe, but I have been sent two collections from the U.S.A., and these are reported here, together with a description and notes on this easily overlooked, diminutive lichen.

Micarea perparvula (Nyl.) Coppins & Printzen, Bibl. Lichenol. 60: 204 (1995). – *Lecidea perparvula* Nyl., Flora 64: 532 (1881). TYPE: [France:] Mont-Dore, vi 1881, *E. Lamy* (H-NYL 20917!, lectotype).

Description. – Thallus inapparent, endoxylic, hyphal walls sometimes olivaceous, K+ violet . Photobiont 'micareoid', cells 4–7 µm diam. Apothecia sessile, immarginate, black, convex-hemisphaerical to subglobose, (0.08–)0.12–0.2 mm diam. Exciple inapparent. Epithecium 7–9 µm tall, dark brown, HNO_3–, K–, but brown pigment partly dissolving, and then some K+ violaceous areas visible. Hymenium 35-40 µm tall, dilute brown, especially in upper part, HNO_3, K± dissolving. Hypothecium dilute brown, HNO_3–, K–. Paraphyses scanty, (0.5-)0.8-1um wide, sometimes widening above to 1.3 µm. Asci clavate, 29–33 x 9–12 µm, *Micarea*-type, with a non-amyloid axial body surrounded by an amyloid tube, 8-spored. Ascospores ellipsoid, ovoid-ellipsoid or oblong-ellipsoid, 6.7–9.8 x 2.5–4 µm, simple or very rarely one or two spores seen to be 1-septate. Pycnidia partly immersed in substratum, black, c. 40 µm diam.; walls olivaceous, K+ violet; conidia (microconidia) bacilliform, 3.8–4.5 x 0.7–1 µm.

Chemistry. – Material insufficient for TLC. Pigments Elachista-brown in epithecium (K+ dissolving, HNO_3–); Sedifolia-grey (K+ violet) in thallus, upper hymenium (often very faint) and pycnidial walls.

The New Jersey material was from a mixed pine (*Pinus rigida*) – oak (*Quercus*) forest with sparse birch (*Betula populifolia*) and maple (*Acer*) woodland. Associated species noted on the herbarium label are *Cladonia* sp., *C. incrassata* Flörke, *Loxospora pustulata* (Brodo & W.L. Culb.), *Diploschistes muscorum* (Scop.) R. Sant., *Mycocalicium subtile* (Pers.) Szatala, and *Trapeliopsis* sp. In addition, I detected ascomata of the 'hemilichen' *Epigloea pleiospora* Döbbeler on one piece of wood. No associated species are identifiable on the Louisiana collection, although the wood is harder and less decayed.

In most respects *Micarea perparvula* is identical to *M. rhabdogena* (Norman) Hedlund, which has been recorded from Massachusetts as *Biatora punctella* Willey (Printzen 1995: 212). The latter species differs in having narrower, oblong-ellipsoid to bacilliform ascospores, 6–9 x 1.5–2.3 µm. Confusion is more likely with *M. misella* (Nyl.) Hedl., owing to its similar ascospores, but that species differs in lacking the brown, K+ dissolving epithecial pigment (Elachista-brown), having a higher concentration of K+ violet pigment (Sedifolia-grey) in the hymenium, and having its apothecia usually accompanied by stalked pycnidia (Coppins 1983, Czarnota 2007).

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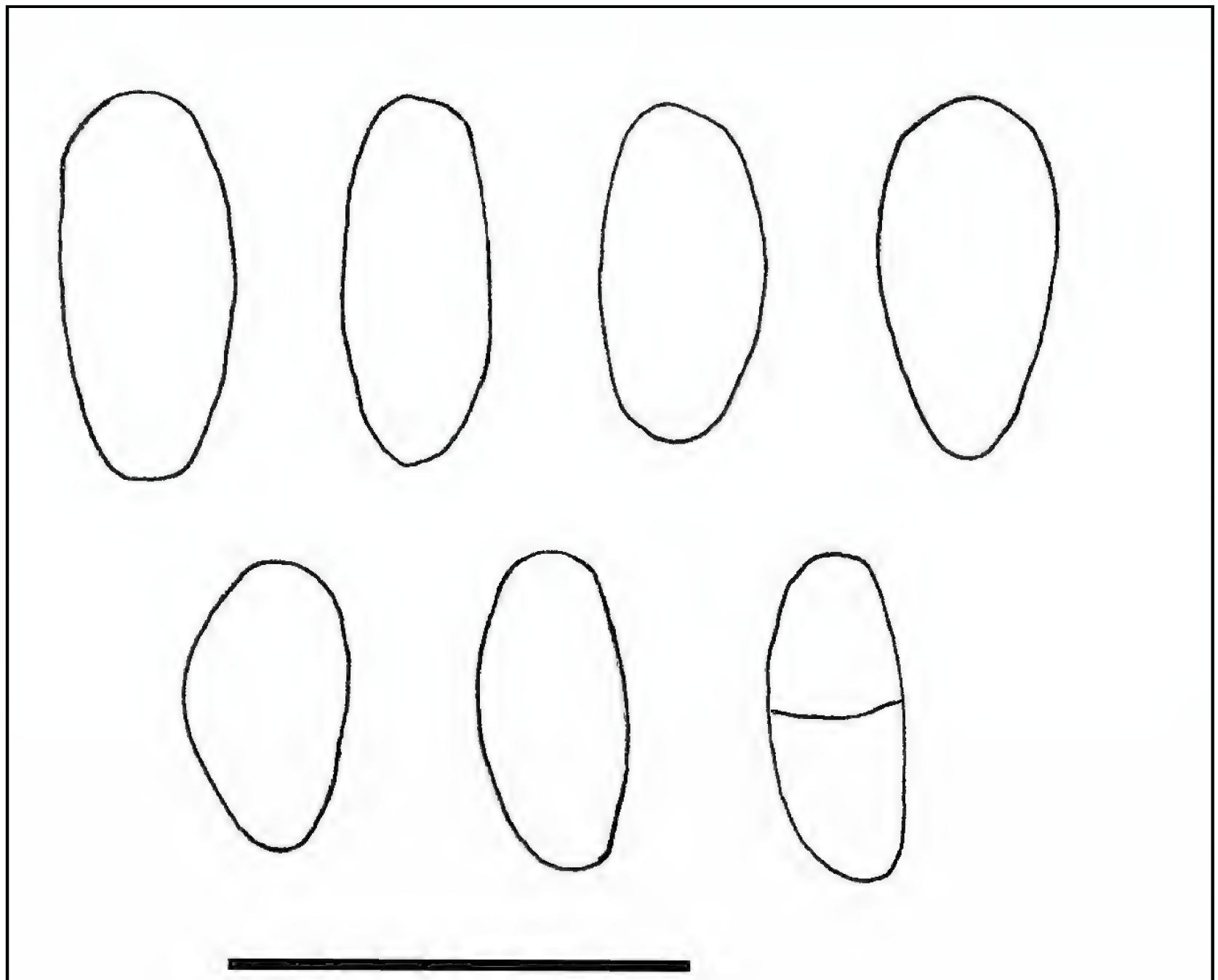

Figure 1. *Micarea perparvula*. Ascospores (lectotype). Scale bar = 10 *µm*.

Specimens Examined. – USA. New Jersey, Atlantic Co.: Wharton State Forest, E of Nesco, NW of Batsto, N of Pleasant Mills Cemetery, elev. 10–20 ft, on a rotting log, 24.x.2004, *J.C. Lendemer 3328* (hb. lendemer). Louisiana. Tangipahoa parish.: NE Amite, E end of Ogden Lane, Amite sand hills, on dead wood on sand, 22.ii.1992, *S. Tucker 31396* (e).

Acknowledgments

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Opuscula Philolichenum, **5**: 25-28. 2008.

Endococcus janae, a new species from Peru on *Acarospora rhabarbarina*

KERRY KNUDSEN[1]

ABSTRACT. – *Endococcus janae* is described from *Acarospora rhabarbarina* in Peru. It has 4-spored asci and differs from other the 4-spored species, *E. zahlbrucknerellae* and *E. variabilis,* in ascomata and spore size as well as host.

Keywords: lichenicolous fungi, Dothideales, Ascomycota.

INTRODUCTION

The lichenicolous genus *Endococcus* comprises at least thirty-eight species (Halici et. al. 2007), most of which have a narrow host spectrum. Three species have recently been described (Hawksworth & Itturriaga 2006; Brackel and Kocourková 2006; Halici et. al. 2007). Important work in understanding the genus was done by Hawksworth (1979) and Triebel (1989). Some species concepts are apparently too artificial, including too broad a difference in ascomata and spore size, as well as too wide a range of hosts (Sérusiaux et al. 1999; Kocourková 2000; Halici et al. 2007). The genus is in need of revision.

METHOD

Sections were prepared by hand and examined in water, 10% KOH, and I (Lugol). Amyloid reactions were tested in I and I with pre-treatment with KOH (K/I). Ascospore measurements were made in water; extreme values are given in parentheses. Ascospore measurements are indicated as (minimum-) *s* $\pm$. *mean* (-maximum), followed by the number of measurements (*n*); the length/breadth ratio of ascospores is indicated as l/b and given in the same way.

THE NEW SPECIES

Endococcus janae K. Knudsen ***sp. nov.***

MYCOBANK #511450

PLATE 1, FIGURES 1-4.

Fungus lichenicola in thallis lichenis Acarospora rhabarbarina. Endococcus species insignis ascomatibus immersis vel semi–immersis, subsphaericis, 125–190µm altis,120–150 latis, ascis 4—sporis, ascosporis brunneis, 1–septatis, (14–)15–15.8(–18) x (6–) 6.4–6.8(–9)µm.

TYPE: PERU: Ica, western foothills of Andes 36–40 km E of Nazca on road to Puquio, on thallus of *Acarospora rhabarbarina,* rhyolite, 2000–2250 m, *Weber & Kohn, L–66453* (COLO, holotype).

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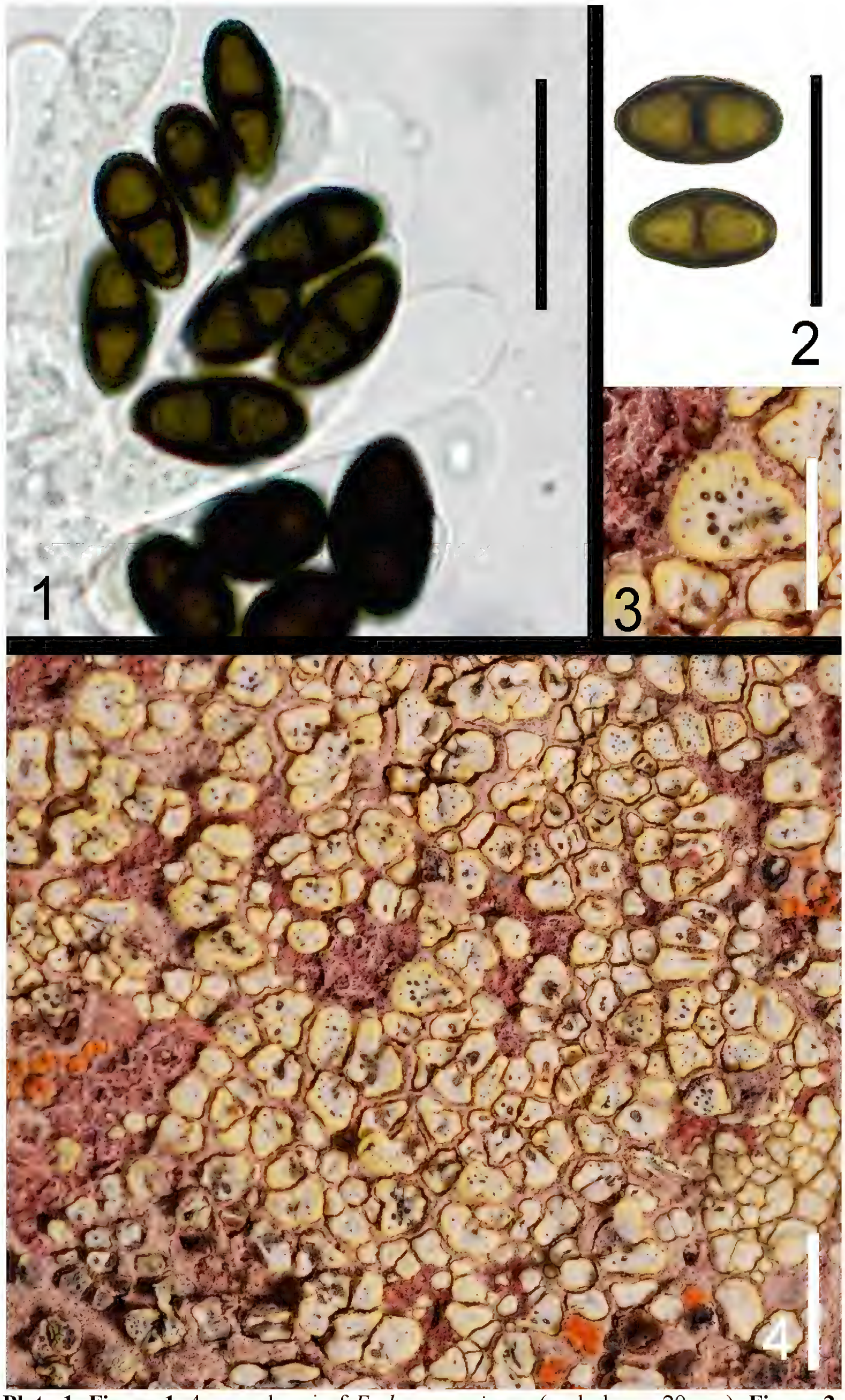

Plate 1. Figure 1, 4-spored asci of *Endococcus janae* (scale bar = 20 µm). **Figure 2**, detail of ascospores (scale bar = 20µm). **Figure 3**, detail of areole of *A. rhabarbarina* showing infection of *E. janae* (scale bar = 2mm). **Figure 4**, holotype of *E. janae* (scale bar = 4mm).

Description. – Lichenicolous fungus growing on the areoles or squamules of the host, the yellow *Acarospora rhabarbarina* Hue, suppressing apothecia production of the host. **Ascomata** perithecioid, arising singly, up to twenty or more per areole or squamule, immersed to erumpent, subglobose, applanate, black and somewhat shiny, with the ostiolar part up to 35 µm wide, with no other visible sign of infection, 125–190µm tall, 120–150µm wide; wall *ca.* 15–20µm thick, dark brown in upper part, hyaline to lightly reddish brown in lower half, of multiple compressed layers, cells hard to discern, mostly 1µm wide, up to 10µm long, K–. **Hamathecium** of periphysoids, lining ostiolar canal and upper part of ascomatal cavity, brown near ostiolar area to hyaline in upper part of ascomatal cavity, simple, or basally branched, or branched in upper third, 25–30µm in length, cells 3–4µm long, 2–3(–4)µm wide; central cavity with hymenial gel and asci, I+orange, K/I+ blue; **Asci** arising from in base and lower sides of ascomatal cavity, sessile, densely–packed, subcylindrical, internal apical beak evident, four–spored (very rarely with five or six spores), 45–50(–60) x 14–16µm, fissitunicate, K/I–; **Ascospores** uniseriate or distichously arranged in asci, ellipsoid, golden brown and simple when young, becoming one–septate and dark brown at maturity, (14–)15–15.8(–18) x (6–) 6.4–6.8(–9)µm (*n*=100), l/b (1.6–)1.9–2.7(–3.0), not constricted at septum, with one or several small oil drops or without, the wall 0.5–1µm thick, dark, ornamented, septum in mature spores dark, 0.5–1.0µm thick, though sometimes thinner, no gelatinous perispore evident; **Conidiomata**, not observed.

Etymology. – The species is named in honor of my colleague, friend, and my future wife Jana Kocourková, who has a special love for the genus *Endococcus* which led to our fortuitous meeting through *Opuscula Philolichenum.*

Discussion. – Currently only one species of *Endococcus* is recognized as occurring on *Acarospora, Endococcus stigma* (Körb.) Stizenb. (Triebel 1989; Kainz & Triebel 2004). *Endococcus stigma* is treated in this paper as having ascomata 150–250µm in diameter, 8-spored asci, and ovoid to broadly ovoid ascospores, with thick ornamented walls, strongly attenuated apices, cells equal, mostly 12–16(–20) x 6–7(–8)µm, becoming constricted at septum in older ascospores, with l/b 2.4 or less (Kainz & Triebel 2004; Knudsen & Kocourková 2007). *Endococcus stigma* has somewhat larger ascomata size than *E. janae* (150–250 µm vs. 125–190µm), and overlapping ascospore size [12–16(–20) x 6–7(–8)µm vs. (14–)15–15.8(–18) x (6–) 6.4–6.8(–9)µm] with *E. janae* having usually longer and broader ascospores. *Endococcus janae* differs from *E. stigma* in having 4-spored asci instead of 8-spored asci as well as having spores with rounded or blunt apices rather than attenuated apices. Another taxon on *Acarospora* with 4-spored asci was reported from the Canary Islands with soleiform ascospores with strongly attenuated apices and included by Hafellner (2002) in *E. stigma* s. lat. *Endococcus janae* differs from Hafellner's taxon in not having soleiform spores with strongly attenuated apices.

Only two described species are known to have 4-spores per ascus, *E. zahlbrucknerellae* (Henssen) D. Hawksw. (Hawksworth 1979; Henssen 1977), which occurs on *Zahlbrucknerella calcarea* (Herre) Herre, and *E. variabilis* Halici, Kocourk. & Diederich (Halici et al 2007), which occurs on *Staurothele areolata* (Ach.) Lettau. Both species differ by their host selection from *E. janae* as well as size. *Endococcus zahlbrucknerellae* has smaller ascomata than *E. janae* (≤100µm vs. 125–190µm), shorter ascospores (12–15µm vs. (14–)15–15.8(–18)µm), and produces galls. *Endococcus variabilis* has larger ascomata than *E. janae* (230–260µm vs. 125–190µm) and has slightly broader spores (6.5–7.5µm vs. 6.4–6.8µm), which overlap in size.

In studying over two hundred specimens of *Acarospora* from South America (Knudsen et al. 2008) and numerous specimens of *Acarospora* from North America (Knudsen 2007), so far I have found only this single incidental collection of *E. janae* from Peru. I have decided to publish this species to encourage the recognition and further collection of specimens of *E. janae*. Its known host, *A. rhabarbarina*, is wide–spread in Argentina, Bolivia, Chile, and Peru but is rare in North America in southern Arizona and California and is expected in Mexico. *Endococcus janae* probably occurs on other species of the genus.

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The lichen genus *Chrysothrix* in the Ozark Ecoregion, including a preliminary treatment for eastern and central North America

Richard C. Harris[1] & Douglas Ladd[2]

ABSTRACT. – The taxonomy of *Chrysothrix* Mont. is reviewed for eastern and central North America with special emphasis on the Ozark Ecoregion. Six taxa are recognized; three of these occur in the Ozarks. The new combination *Chrysothrix onokoensis* (Wolle) R.C. Harris & Ladd is made and the new species *Chrysothrix insulizans* R.C. Harris & Ladd is described. Eastern North American material previously determined as *Chrysothrix candelaris* is referred to *C. xanthina*. A key, descriptions, illustrations and distribution maps are provided.

Introduction

Attempting to catalogue all of the lichens of a region, such as the Ozarks, often leads to critical re-evaluation of previously accepted concepts. Inspired by Kalb (2001) to take a close look at our *Chrysothrix* Mont. specimens, we found that our previous determinations were wrong. Laundon's (1981) pioneering treatment proposed very broad species concepts and accordingly we initially assigned collections of *Chrysothrix* on rock to *C. chlorina* (Ach.) J.R. Laundon and collections on bark or wood to *C. candelaris* (L.) J.R. Laundon. It turns out that neither of these species is actually known from the Ozark region. The situation was further confused in that a few saxicolous specimens of *Chrysothrix* had been misdetermined as sterile *Chaenotheca furfuracea* (L.) Tibell. In the Ozarks, corticolous specimens are now assigned to *C. xanthina* (Vainio) Kalb, which also rarely occurs on rocks. Two additional saxicolous species are recognized in the Ozarks (one of them previously undescribed). In the process of resolving our Ozark problems, limited additional material from eastern and central North America was reviewed. Based on these data, it appears that *Chrysothrix chlorina* is apparently a northern species, and *C. xanthina*, thought by Kalb to be a tropical/subtropical species, is common as far north as New England and Minnesota. It is clear that further work is needed to resolve species problems in *Chrysothrix* in eastern North America, especially outside the Ozark region.

This paper was originally begun as a contribution to the volume honoring Klaus Kalb (Fritsch et al. 2007) but Ozark *Chrysothrix* proved too messy to meet the deadline for inclusion. Therefore, it is somewhat belatedly dedicated to Klaus Kalb, who among his many contributions to tropical lichenology, began the deconstruction of *Chrysothrix*.

Because of their prominent yellow coloration, *Chrysothrix* thalli are readily evident in the field. They typically occur in microhabitats with a combination of moderate to high light intensities and limited exposure to direct wetting. Corticolous species tend to inhabit relatively mesic habitats, growing in bark

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crevices and on the protected undersides of leaning boles, in areas that are either protected from direct runoff, or drain and dry quickly after wetting. At least in the Ozarks, calicioid lichens, particularly species of *Mycocalicium*, are a frequent associate on corticolous substrates. With the exception of *Chrysothrix flavovirens*, which always occurs on conifers, most corticolous species inhabit a wide range of hardwoods and conifers.

Saxicolous species of *Chrysothrix* occur on acidic siliceous rocks, often in areas with high light levels that are protected under overhanging bluffs and ledges. In more exposed habitats, thalli tend to occur on vertical or inversely slanted surfaces. Almost all saxicolous populations in the Ozarks occur on massive rock substrates, as opposed to cobbles and fragments.

Methods

Granules were measured dry with a Zeiss Stemi 200-C with an Olympus DP20 digital camera using Microsuite Special Edition. Microscopic characters were measured in water with an Olympus BX51 microscope with camera and software as above. Chromatography was done variously with Merck glass and aluminum plates mostly with chloroform-acetone 4:1, but some with chloroform-methanol 10:1 or generally following the three solvent system of Culberson and Kristinsson (1970). The identification of leprapinic acid is tentative, based on co-chromatography with a duplicate of *Chrysothrix occidentalis* Elix & Kantvilas (Nepal, Weber L-87604). For complete collection data see http://sciweb.nybg.org/science2/VirtualHerbarium.asp.

Character synopsis for *Chrysothrix* and some similar taxa in eastern and central North America. Taxa documented from the Ozark Ecoregion are in **bold.** Minor constituents are in parentheses

Taxon	substrate		granule size, µm	calycin	pinastric	vulpinc	leprapinic?	rhizocarpic	zeorin	parietin
	bark/ wood	rock								
Chrysothrix candelaris	●		50-75	±	±					
Chrysothrix chlorina		●	45-75	+		+			+	
Chrysothrix flavovirens	●		15-25(30)					+		
Chrysothrix insulizans	●	●	20-50	+			+			
Chrysothrix onokoensis		●	20-80				+			
Chrysothrix xanthina	●	●	25-40		+					
Chrysothrix sp.	●		25-45(65)	+	±					
Similar taxa:										
Caloplaca chrysodeta		●	(35) 45-85							+
Chaenotheca furfuracea	●	●	38-65			+				
Psilolechia lucida	●	●	30-55					+		

Taxonomy

Key to *Chrysothrix* and *Chrysothrix*-like taxa in eastern North America

1. Photobiont chlorococcoid, the cells ± isodiametric; thallus chemistry various 2

2. On bark or wood 3

3. Granules small, 15-45 µm across; calycin or leprapinic? acid or pinastric acid or rhizocarpic acid as the major substance; eastern North America 4

4. Thallus usually bright yellow, UV- (leprapinic? acid or pinastric acid or calycin); granules 25-45µm; on hardwoods or conifers 5

5. Major substance pinastric acid or leprapinic? acid (K–, KC–); on trees and wood 6

6. Pinastric acid major; widespread in eastern U.S .....*C. xanthina*
6. Leprapinic? acid major; specimens on *Quercus* & palm, southern Coastal Plain or on *Abies*, Maine & Michigan ..... *C. insulizans s. lat*

5. Major substance calycin (often K+ slowly reddish); typically on *Quercus*; Alabama, Florida & Georgia ..... *Chrysothrix sp.*

4. Thallus dull pale yellow to pale greenish yellow (whitish yellow with age in herbarium), UV + dull to bright orange (rhizocarpic acid); granules small, 15-25(-30) µm across, "loose", without binding hyphae; exclusively on conifers ..... *C. flavovirens s. lat.*

3. Granules coarser, 35-80 µm across; calycin and/or pinastric acid; not seen from eastern North America ..... *C. candelaris*

2. On rock 7

7. On acidic siliceous rock; thallus K- to K+ slowly reddish (calycin)..... 8

8. Thallus thick, attached to rock by rhizohyphae (these sometimes not evident); usually easily separated from rock 9

9. Thallus UV± dull orangish (leprapinic? acid), of loosely aggregated granules with numerous projecting hyphae, bicolor in section, yellow above, whitish to brown below (fig. 8); Ozarks, Pennsylvania & S.E. U.S ..... *C. onokoensis*
9. Thallus UV– (calycin, vulpinic acid, zeorin), usually of more tightly compacted granules, mostly without obvious projecting hyphae, ± uniform yellow in section; Ontario, Vermont ..... *C. chlorina*

8. Thallus thin, lacking rhizohyphae, of scattered to contiguous granules or leprose; rarely easily separable from rock 10

10. Thallus K– (pinastric or rhizocarpic acid), forming a thin, ± continuous, granular crust 11

11. Thallus bright yellow to bright greenish yellow, UV– (pinastric acid); normally on bark, rarely on rock ..... *C. xanthina*
11. Thallus pale yellow to pale greenish yellow, UV+ dull to bright orange (rhizocarpic acid); normally on rock, often in heavily shaded crevices of fieldstone walls, rarely on bark or wood ..... *Psilolechia lucida*

10. Thallus K+ slowly reddish (calycin + leprapinic? acid), forming small ± round patches on rock, sometimes forming large continuous, rimose or rimose-areolate patches with rounded soralium-like outliers .....*C. insulizans*

7. On calcareous rock; thallus K+ instantly magenta-purple (parietin) .....*Caloplaca chrysodeta*

1. Photobiont *Stichococcus,* the cells subrectangular to elongate; thallus containing vulpinic acid .... sterile *Chaenotheca furfuracea*

Plate 1. Figure 1. *Chrysothrix xanthina*, Arkansas, Izard Co., *Buck 40233*. **Figure 2.** *C. candelaris*, Germany, *Funck*. **Figure 3.** *C. flavovirens*, New Jersey, Burlington Co., *Harris 43831*. **Figure 4.** *C. insulizans*, Missouri, Shannon Co., *Ladd 18690* (holotype). **Figure 5.** *C. onokoensis*, Arkansas, Franklin Co., *Harris 49242*. **Figure 6.** *C. chlorina*, Norway, Hordaland, *Havaas*. (all NY). Bar = 200 µm.

Chrysothrix candelaris (L.) J.R. Laundon

PLATE 1, FIGURE 2.

DESCRIPTION. - **Thallus** leprose, of thin, scattered granules coalescing into a ± continuous, non-areolate crust, bright yellow, often with orangish or greenish tinge or rarely greenish yellow, unstratified, without marginal lobes; photobiont chlorococcoid, with ± spherical cells to 15 (-18) µm across. **Chemistry**: K+, KC+ reddish or K–, C–, PD–, UV–; three chemotypes 1) calycin; 2) calycin + pinastric acid; 3) pinastric acid. **Granules** ± spherical, 50-75 µm across. **Apothecia** not seen. **Pycnidia** not seen. (partly modified from Laundon, 1981).

DISCUSSION. - All specimens seen by us from eastern and central North America that had been identified as *C. candelaris* are indistinguishable from *C. xanthina* in granule size and chemistry. The granules are 25-40 µm in diameter, (20-50µm for *C. xanthina*, Kalb, 2001), averaging 29-36.5 µm, and contain pinastric acid as the major substance. According to Kalb (2001) *C. candelaris* has granules 75-200 µm in diameter and contains calycin as the major substance. Based on measurements of eight European collections, we observed granules 50-75 µm (averages 44.5-69 µm), somewhat smaller than given by Kalb (2001), but not overlapping those of *C. xanthina*. Harris has been aware since the early 1970s that eastern North American material assigned to *C. candelaris* contains pinastric acid as the major substance, and, not realizing that size matters, annotated some specimens as *Lepraria citrina* (Schaer.) Rabenh. (type collection pinastric acid major, confirmed by Kalb 2001). However, in an isotype of *Lepraria citrina* Schaer. (Schaer. Lich. Helv. 3, NY) the granules are larger than in *C. xanthina* (56-73 µm in diameter) suggesting that it may be a chemotype of *C. candelaris* or an unrecognized species.

SPECIMENS EXAMINED. - **FRANCE**. Orne et Calvados, *Olivier,* Lich. Exs. 150; sine loc, *Desmazières*, Pl. crypt. ed. 1, 682 (NY). **GERMANY**. Fichtelgebirge, *Funck*, Crypt. Gew. Fichtelberg. 705 (NY). **SCOTLAND**. SOUTH AYRSHIRE. Culzean Castle and County Park, *King L230* (NY). **SWEDEN**. BLEKINGE. Trensum Par., Hällaryd, *Kärnefelt 2718* (NY).

Chrysothrix chlorina (Ach.) J.R. Laundon

PLATE 1, FIGURE 6; PLATE 3, FIGURE 11 (map).

DESCRIPTION. - **Thallus** thick, continuous to strongly areolate, bright yellow, ecorticate, loosely attached and easily separated from rock, lacking well-defined lobes, forming extensive, irregularly spreading patches, to ca. 1.0 mm thick, ± densely compact in central parts, consisting of yellow granules which become paler toward base; rhizohyphae not evident to well developed; photobiont chlorococcoid, spherical, to 18 µm across. **Chemistry**: K±, KC± reddish, C–, PD–, UV–; calycin, vulpinic acid and zeorin (minor) (not usually reported for *C. chlorina* but was found also by Tønsberg 1992). **Granules** variable, spherical or ± irregular, 40–75 µm across (100-200 µm, Laundon, 1981), occasionally with projecting hyphae; hyphae colorless, 2.0-5.0 µm thick. **Apothecia** not seen. **Pycnidia** not seen.

DISCUSSION. - *Chrysothrix chlorina* is separated from the morphologically similar *C. onokoensis* by chemistry (calycin, vulpinic acid and zeorin vs. leprapinic? acid), and to a lesser extent in more frequently having the granules without projecting hyphae compacted into a denser crust which is not obviously bicolor in section (lacking a distinct layer of rhizohyphae in eastern North American material) although the lower parts may be paler. From the limited material examined, *C. chlorina* seems to have a distinctly northern distribution in eastern North America.

SPECIMENS EXAMINED. - **CANADA. ONTARIO**: THUNDER BAY DIST.: Hwy 593, 10 km S of Silver Mountain, *Barclay 9819* (CANL), small lake 1 mi. NE of Sturgeon Bay, *Garton 8474* (CANL), Spur Bay at SW corner of Ombabika Bay, Lake Nipigon, *Garton 20892* (CANL), N end of Inner Barn Island, Wabinosh Bay, Lake Nipigon, G*arton 20992* (CANL, NY) **U.S.A. VERMONT**, WINDHAM CO.: Brattleboro, *Russell* (NY).

Chrysothrix flavovirens Tønsberg *s. lat.*

PLATE 1, FIGURE 3; PLATE 3, FIGURE 9 (map).

DESCRIPTION. - **Thallus** crustose, leprose, thin, on bark of conifers, dull yellow or greenish yellow (becoming whitish yellow in herbarium), unstratified, ± spherical or irregular granules coalescing into small discontinuous patches, more often forming extensive patches, one-few granules thick; rhizohyphae absent; photobiont chlorococcoid, to 8.5 µm across. **Chemistry**: spot tests negative, UV+ dull to bright orange; rhizocarpic acid. **Granules** spherical to ± irregular, 15-25(-30) µm across, "loose" (i.e., fungal hyphae linking granules absent). **Apothecia** not seen. **Pycnidia** not seen.

DISCUSSION. - *Chrysothrix flavovirens* as treated here presents two problems. The first is that all eastern North American material, although indistinguishable in morphology from an isotype (Tønsberg, Lich. Isid. Sored. Crust. 7, NY) and in having the same substrate preference for conifer bark as in Europe, lacks diffractaic acid and, thus, is provisionally included in a broad concept of the species as an acid deficient chemotype. The second is that the granules seem to lack any hyphae binding them into a ± coherent thallus suggesting that there may not be a close relationship between *C. flavovirens* and the rest of *Chrysothrix*.

The combination of dull, often greenish yellow color, very small granules (averages of four specimens 20(-25) µm) and growing exclusively on conifers, usually in humid, shaded habitats, is distinctive for *C. flavovirens*. It appears to be relatively common, perhaps confined to the Coastal Plain, ranging from south-central Florida to Maine. It has not been collected in the Ozarks. Substrates include a wide range of conifers: *Chamaecyparis, Pinus, Taxodium*, and *Tsuga*.

SPECIMENS EXAMINED. - **U.S.A. ALABAMA**. BALDWIN CO.: Splinter Hill Bog Preserve, *Lendemer 9062* (NY); JACKSON CO.: Pisgah, Jones Cove, below Pisgah Civitan Park, *Harris 43334* (NY). **CONNECTICUT**. TOLLAND CO.: Town of Mansfield, N of end of White Oak Road, *Harris 46158* (NY). **FLORIDA**. BAKER CO.: Along CR 127 at Moccasin Creek, *Harris 39281* (NY); FLAGLER CO.: Along Co. Rd. 304 at Sweetwater Creek, *Harris 37424* (NY); GILCHRIST CO.: Wacasassa Flats, *Harris 31680* (NY); HAMILTON CO.: Bee Haven Bay, N of Co. Rd. 6, *Harris 32502* (NY); POLK CO.: Walter Heiler Development near Nalcrest, *Wheeler s.n.* (NY); SUMTER CO.: Green Swamp Wildlife Management Area, Cross Creek Swamp, *Harris 41625* (NY). **MAINE**. YORK CO.: Massabesic Experimental Forest, *Harris 46235* (NY). **MARYLAND**. WORCESTER CO.: Hickory Point Cypress Swamp, *Lendemer 6356* (NY), *Lendemer 6361* (NY). **NEW JERSEY**. ATLANTIC CO.: Mullica River system, NW of Pleasant Mills Cemetery, *Lendemer 3293* (NY); N bank of Tuckahoe River, *Lendemer 7566* (NY); BURLINGTON CO.: Mt. Misery, E of Mt. Misery Road, *Buck 47393* (NY); Shinn's Branch, Lebanon State Forest, *Anderson s.n.* (NY); Wharton State Forest, Quaker Bridge, *Brodo 29809* (CANL), *Harris 43831*(NY); CUMBERLAND CO.: Edward Bevin Wildlife Management Area, *Lendemer 1910* (NY); Gloucester Co.: Glassboro/Clayton Wildlife Management Area, *Harris 43831* (NY); SUSSEX CO.: Stokes State Forest, Tillman Ravine, *Harris 27952* (NY). **NEW YORK**. DUTCHESS CO.: Carey Arboretum, *Harris 13397* (NY), *Harris 14069* (NY); SUFFOLK CO.: Cranberry Bog Nature Preserve, *Harris 19415* (NY). **NORTH CAROLINA**. CRAVEN CO.: N of Flanners Beach Road, *Lendemer 3728* (NY); WAKE CO.: William B. Umstead State Park, *Lendemer 8048* (NY), *Lendemer 8393* (NY), *Perlmutter 786* (NY). **PENNSYLVANIA**. MONROE CO.: Delaware Water Gap Natl. Recreation Area, *Harris 49523* (NY), *Lendemer 4936* (NY) (Lendemer, Lich. E. N. Amer. 213). **RHODE ISLAND**. WASHINGTON CO.: Marion Eppley Wildlife Sanctuary, *Harris 53128* (NY).

Chrysothrix insulizans R.C. Harris & Ladd, ***sp. nov.***
MYCOBANK #511492.

PLATE 1, FIGURE 4; PLATE 3, FIGURE 10 (map).

Chrysothrix saxicola ab aliis speciebus saxicolis thallo tenui dispersoque, primo soraliis simili, demum plus minusve continuo areolatoque, sorediis 25-30 µm in diametro et calycin et acidum leprapinicum? continenti differt.

TYPE. **U.S.A. MISSOURI**. SHANNON CO.: Ozark National Scenic Riverway, in Prairie Hollow Gorge Natural Area, east of hwy V, W1/2 sec. 15 T29N R3W, on shaded rhyolite face under massive overhang on west-facing slope, 18 May 1995, *Ladd 18690* (NY, holotype).

DESCRIPTION. - **Thallus** crustose, leprose, thin to moderately thick, bright yellow to yellow-green or yellow-orange, unstratified, adnate, forming small, ± round or irregular soralium-like colonies, one-few granules thick to 200 µm, often remaining discontinuous but also forming or coalescing into larger, continuous, rimose or rimose-areolate patches several cm. across and then to 500 µm thick; rhizohyphae absent; photobiont chlorococcoid, spherical, 9–14 µm across. **Chemistry**: K+ reddish, C–, KC + reddish, PD–, UV–; calycin (major) and leprapinic? acid (± major), unknown pulvinic acid derivative (tr.). **Granules** farinose, ± spherical, 20–50 m across; hyphae 2-2.5 µm wide. **Apothecia** not seen. **Pycnidia** not seen.

DISCUSSION. - The epithet "insulizans", meaning "island-forming", derives from the thallus which very often consists of separate soralium-like patches. *Chrysothrix insulizans* is separated from the other North American species on rock in containing calycin (K+ reddish) and the thin, often discontinuous thallus. *Chrysothrix insulizans* may prove identical to the Australian and Asian *C. occidentalis* (Elix & Kantvilas 2007) but is maintained as distinct here mainly based on geography and a minor chemical difference (calycin minor in the latter). We have not seen enough material to evaluate possible morphological differences.

We initially believed that *C. insulizans* was strictly saxicolous but a handful of corticolous specimens have been found with identical chemistry. They fall into two groups: a southern Coastal Plain population which is ± within the geographical range of the saxicolous material (thus more likely to be *C. insulizans*), and a northern population (Maine & Michigan) occurring on *Abies* which is probably a distinct taxon requiring molecular methods for a definitive disposition.

Chrysothrix insulizans typically occurs on non-calcareous rock, often shaded under overhangs but also in exposed situations. It has a S.E. U.S.-Ozark distribution. Most collections are from sandstone, but it also occurs on rhyolite, granite, and cherty dolomites.

SPECIMENS EXAMINED. - **U.S.A. ARKANSAS**. MONTGOMERY CO.: E of Little Missouri Falls, Ouachita Natl. Forest, *Sharnoff & Sharnoff 1049.14* (CANL); STONE CO.: Ozark Natl. Forest, Blanchard Springs Recreational Area, *Ladd 15355* (HB. LADD). **FLORIDA**. PUTNAM CO: Along C.R. 21, 2.7 mi S of Johnson, *Harris 39870* (cort., NY); VOLUSIA CO.: Daytona Beach Peninsula, *Shchepanek 29A* (cort., CANL); WASHINGTON CO.: Rock Hill, ca. 7 mi due SE of Chipley, E of Co. Rd. 273 just S of I-10, *Harris 35596* (NY). **GEORGIA**. CHARLTON CO.: Okefenokee Natl. Wildlife Refuge, along Suwannee Canal, *Wetmore 65307* (cort., NY); COFFEE CO.: Broxton Rocks Ecological Preserve, 9 mi E of Broxton, 3 mi S of Ocmulgee River, *Harris 32603* (NY); Broxton Rocks Ecological Preserve, Ricketson Tract, *Harris 36120* (NY); JEFF DAVIS CO.: 0.4 mi E of Coffee Co. line on Georgia Hwy 107, *Harris 36190* (NY); ROCKDALE CO.: Panola Mountain State Park, *Lendemer 9003* (NY) (LENDEMER, LICH. E. N. AMER. 274). **MISSOURI**. CARTER CO.: Bluff on E side of Current river across from Big Spring S of Van Buren, *Harris 25664* (NY); CRAWFORD CO.: Woodson K. Woods Memorial Conservation Area *Lendemer 6081* (NY); IRON CO.: Royal Gorge, along St. Rd. 21/72 1.7 mi S of jct with Co. Rd. CC, *Harris 21794* (NY), *Ladd 6188* (HB. LADD); NEWTON CO.: Wildcat City Park at S edge of Joplin, Silver Creek Glade, *Buck 42971* (NY); REYNOLDS CO.: St. Francis Mountains, Johnson Shut-Ins State Park, *Harris 31226* (NY); STE. GENEVIEVE CO.: Canyon in LaMotte sandstone along upper reaches of Fourche DuClos, 2.1 mi SW of Lawrenceton, *Ladd 20243* (HB. LADD); SHANNON CO.: MOFEP site 4, in Cardareva State Forest, *Chadwell 65* (NY); Ozark Natl. Scenic Riverways, Rocky Falls, *Buck 18082* (NY); Ozark Natl. Scenic Riverways, Prairie Hollow Gorge, *Buck 18177* (NY). WAYNE CO.: Sam A. Baker State Park, Shut-Ins Trail, along Big Creek, *Buck 45365* (NY), *Ladd 17086* (NY, HB. LADD). **NORTH**

CAROLINA. Carteret Co.: Cape Lookout National Seashore, Shackleford Banks, *Harris 47176* (cort., NY); Jackson Co.: Cedar Cliff Mountain, ca. 3.5 mi E of Tuckasegee (NC 107) on NC 281, *Harris 33035* (NY); Macon Co.: Nantahala Natl. Forest, McDowell Mountain, *Harris 33122* (NY). **OHIO**. Jackson Co.: Along old US 35, just W of Jackson Co. Road 28, *Buck B101* (CANL). **OKLAHOMA**. Latimer Co.: Robber's State Park, *Keck 1685* (NY). **SOUTH CAROLINA**. Abbeville Co.: Sumter Natl. Forest, Parsons Mountain, *Harris 40293* (NY); Greenville Co.: Along US 276, 0.2 mi downhill of Bald Rock, *Harris 43451* (NY); Lancaster Co.: Forty Acre Rock Heritage Preserve, just S of Taxahaw, *Harris 43486* (NY).

Specimens Examined From Abies. – **MAINE**. Hancock Co.: Acadia Natl. Park, Schoodic Peninsula, *Sullvan 2260* (CANL). **MICHIGAN**. Cheboygan Co.: Iron Bridge at Carp Creek, *Riefner 81-364* (NY); Delta Co.: ca. 0.3 mi S of Portage Bay Campground, *Harris 11969* (CANL, NY); Keweenaw Co.: Isle Royale Natl. Park, bog behind Checker Point on S. shore of Siskiwit Bay, *Wetmore 48771* (CANL).

Chrysothrix onokoensis (Wolle) R.C. Harris & Ladd, ***comb. nov.***

Mycobank #511495.

Bulbotrichia onokoensis Wolle, Bull. Torrey Bot. Club 6: 141. 1877. TYPE: sine loc. [Pennsylvania, Carbon Co.: Glen Onoko], 1875, *Wolle* (PH 1060002 [barcode 6109], lectotype, **designated here**).

PLATE 1, FIGURE 5; PLATE 2; PLATE 3, FIGURE 11 (map).

Description. - **Thallus** crustose, leprose-byssoid, thick, bright yellow to bright yellow-green, ecorticate, loosely attached and easily separated from rock, lacking well-defined lobes, forming extensive, irregularly spreading patches to 10 cm wide, to ca. 1.0 m thick, consisting of an upper layer of yellow granules and a lower layer of whitish to brownish rhizohyphae, to 0.6 mm thick (fig. 8); rhizohyphae brown (initially colorless), 3.5-6.5 µm thick; photobiont chlorococcoid, spherical, (7-)10-15(-20) µm across. **Chemistry**: spot tests negative, UV± dull orange; leprapinic? acid. **Granules** variable, spherical or ± irregular, 20–80 µm across, usually with projecting hyphae; hyphae colorless, 2.5-4.5 µm thick, with rough, colorless sheath, to 1.0 µm thick. **Apothecia** not seen. **Pycnidia** not seen.

Discussion. - Although *Bulbotrichia* (= *Trentepohlia*) *onokoensis* was described as an alga, it was promptly recognized as a lichen by the distinguished botanist (though not a lichenist) Asa Gray (1878) in a letter to the editor of the Torrey Botanical Club Bulletin which may be taken as a model of polite rebuke.

> "§ *215*. DEAR MR. EDITOR :-Considering that your worthy CLUB bears the name of that venerable man and scrupulously conscientious botanist who disliked most of all hasty and inconsiderate publication of genera, and species, may an old botanist advise some younger ones to make haste more slowly? In particular, the proper determination of low *Algae* and *Fungi* requires not only critical study of many forms with the best appliances, but also a good acquaintance with the literature of the subject at first hand.
>
> It is not my vocation to look after Cryptogamic botany, and I am sincerely desirous to avoid giving offence. Yet I will venture a few remarks upon Mr. Wolle's papers on Fresh Water Algae.
>
> … " *Bulbotrichia onokoensis"* is founded on the young thallus of a Lichen."

Gray's observation then languished for 128 years until James Lendemer, in the process of databasing algal types at the Academy of Natural Sciences of Philadelphia recognized *Bulbotrichia onokoensis* was a *Chrysothrix*. There was some minimal excuse for Wolle's error since *Trentepohlia* often forms orange tufts on moist rock although the color of the *Chrysothrix* is yellow, not orange.

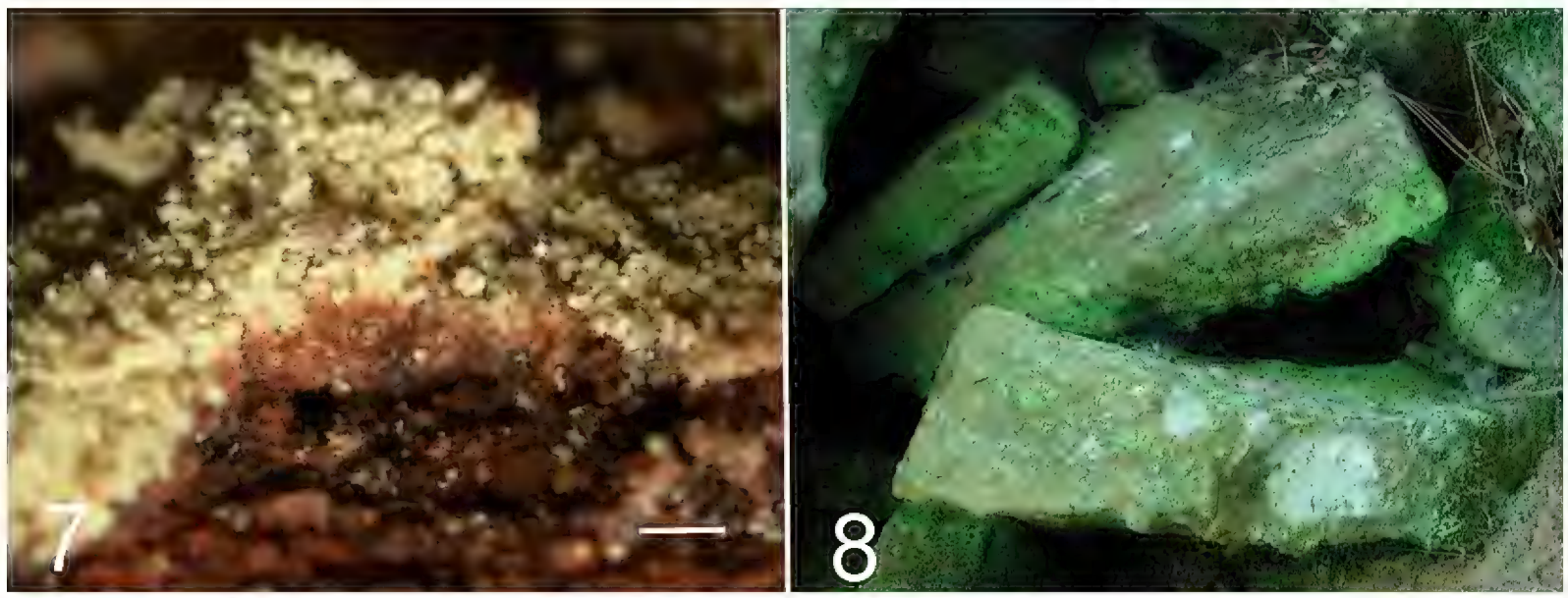

Plate 2. Figure 7. *Chrysothrix onokoensis*, section of thallus, Arkansas, Crawford Co., *Buck 46663* (NY). Bar = 0.5 mm. **Figure 8.** *C. onokoensis*, habit, Arkansas, Franklin Co., *Harris 49242* (NY, photo: Tony Kirchgessner).

Embarrassingly we also had problems (although not of the above magnitude) placing this species since we initially identified some specimens of *C. onokoensis* as sterile *Chaenotheca furfuracea* (L.) Tibell which differs in photobiont (*Stichococcus* vs. chlorococcoid) and chemistry (vulpinic acid vs. rhizocarpic acid). It was also initially identified as *Chrysothrix chlorina* which differs in having more compact thallus cross-section ± uniformly colored (two layered in *C. onokoensis*) and in containing calycin, vulpinic acid and zeorin. Also, pending further study, *C. onokoensis* and *C. chlorina* do not overlap in distribution (fig. 11). *Chrysothrix insulizans* likewise grows on rock and *C. xanthina* rarely also; *C. insulizans* differs in thinner, more discontinuous thallus lacking rhizohyphae and containing calycin and leprapinic? acid, *C. xanthina* in thin, granular thallus lacking rhizohyphae containing pinastric acid. Australian *C. tchupalensis* Elix & Kantvilas (Elix & Kantvilas 2007) has a similar morphology and contains leprapinic acid but differs in also containing a xanthone (no xanthones have been detected in *C. onokoensis*).

Chrysothrix onokoensis grows on shaded sandstone with the exception of the specimen from Alabama which is on limestone. The Pennsylvania collection seems out of the main range of the species but Glen Onoko is known to harbor rare vascular plants disjunct from more southern regions (including the Ozarks) (Pretz 1911).

Specimens Examined. - **ALABAMA**. DeKalb and Marshall cos.: Buck's Pocket State Park, *Buck 34704* (NY). **ARKANSAS**. Crawford Co.: Ozark Natl. Forest, along Forest Service Road 1725 (CR 257), 0.2 mi NW of jct with Forest Service Road 1716 *Buck 46663* (NY); Franklin Co.: Ozark Natl. Forest, Boston Mountain Ranger District, Shores Lake, *Buck 46699* (NY), *Buck 49565* (NY), *Harris 49242* (NY), *Ladd 25832* (HB. LADD), *Ladd 27571* (HB. LADD), *Lendemer 5501* (NY); Madison Co.: Boston Mountains, Ozark Natl. Forest, White Rock Wildlife Management Area, Beech Hurricane Ravine, *Buck 37357* (NY), *Ladd 22198* (HB. LADD); Newton Co.: Boston Mountains, Ozark Natl. Forest, Alum Cove Recreation Area, *Harris 21507* (NY), Ozark Natl. Forest, near SW corner of Upper Buffalo Wilderness, *Lendemer 6567* (NY); Stone Co.: Ozark Natl. Forest, Blanchard Springs Recreation Area, *Ladd 15347* (HB. LADD). **GEORGIA**. Coffee Co.: Broxton Rocks Ecological Preserve, *Buck 24970* (NY), *Buck 30501* (NY). **PENNSYLVANIA**. Carbon Co.: Cliffs Lehigh Valley, *Wolle* s.n. (PH, syntype).

Chrysothrix xanthina (Vain.) Kalb

syn. nov. *Bilimbia aurata* Riddle, in Britton & Millspaugh, Bahama Flora 543. 1920. Type. Bahamas, New Providence, Farrington Road, 24 Aug 1904, *E. G. Britton 2221* (NY, isotype, pinastric acid!).
? *Bilimbia stevensonii* Fink ex J. Hedrick, Mycologia 22: 251. 1930. Type. Puerto Rico, near Rio Piedras, *Stevenson 5163* (MICH, holotype, chemistry not studied).

PLATE 1, FIGURE 1; PLATE 3, FIGURE 12 (map).

DESCRIPTION. - **Thallus** crustose, leprose, thin, on bark, wood and rarely rock or bryophytes, bright yellow or greenish yellow, unstratified, of ± scattered granules usually coalescing into small discontinuous patches, sometimes into more extensive patches, when ± continuous one-few granules thick to ca. 100 µm, occasionally remaining as mostly separate granules; rhizohyphae absent; photobiont chlorococcoid, to 15 µm across. **Chemistry**: spot tests negative, UV–; pinastric acid. **Granules** spherical to ± irregular, 25-40 µm across; hyphae 2-4 µm across. **Apothecia** on a single Florida specimen (*Buck 28935*), arthonioid, yellow pruinose, ca. 0.1-0.2 mm across; spores 3-septate, ca. 10.5-12 x 2.5-3 µm (± immature?). **Pycnidia** not seen.

DISCUSSION. - *Chrysothrix xanthina* is distinctive in its relatively thin thallus, small granules, production of pinastric acid and occurrence on bark or wood. Rare specimens on rock are distinguished from *C. onokoensis* by thin thallus lacking rhizohyphae and from *C. insulizans* by more continuous thallus and producing pinastric acid instead of leprapinic? acid and calycin. Corticolous material assigned to *C. insulizans* is morphologically very similar and only separable with chromatography.

Kalb (2001) resurrected *C. xanthina* from the synonymy of *C. candelaris* based on chemistry and soredial size (see above under *C. candelaris*). Kalb (2001) considered it a subtropical/tropical taxon and cited a single Florida specimen. However, material indistinguishable from his concept of *C. xanthina* is widely distributed in eastern North America from the Canadian border to Florida, and westward to the eastern edge of the mixed grass prairie regions of the Great Plains, occurring on both hardwoods and conifers. A variety of trees with both acidic and circumneutral to slightly basic bark are common substrates, including most of the common genera of trees in the region: *Acer, Betula, Carpinus, Carya, Cercis, Crataegus, Fraxinus, Gleditsia, Gymnocladus, Juglans, Juniperus, Nyssa, Pinus, Platanus, Prunus, Quercus, Taxodium* and *Tilia*. This species also occurs on decorticate hardwood and softwood, and rarely on lightly shaded, sheltered sandstone.

The synonyms cited above were not included in Laundon (1981); both have apothecia. Since becoming aware of the critical characters in *Chrysothrix*, we have not re-examined the type material of *Bilimbia stevensonii* so that we have no record of soredial size or chemistry. Its definitive disposition is left for future study.

SPECIMENS EXAMINED (ON BARK OR WOOD UNLESS OTHERWISE NOTED). - **ALABAMA**. BALDWIN CO.: Splinter Hill Bog Preserve, *Harris 53332* (NY); BIBB CO.: Talladega Natl. Forest, Reed Brake Research Natural Area, *Harris 28885* (NY); CLAY CO.: Talladega Natl. Forest, Cheaha Wilderness, Chinnabee Silent Trail, *Harris 28384* (NY); ESCAMBIA CO.: Escambia Creek Wildlife Management Area, *Buck 51671* (NY); Solon Dixon Forestry Education Center, *Lendemer 9458* (NY); MARSHALL CO.: Lake Guntersville State Park, *Lendemer 4857* (NY). **ARKANSAS**. BAXTER CO.: Ozark Natl. Forest, Leatherwood Wilderness, *Harris 51199* (NY); BENTON CO.: Hobbs State Park-Conservation Area, *Harris 51709* (NY); CARROLL CO.: Dolomite bluff along White River north of hwy 62 bridge, *Ladd 22628* (HB. LADD); FRANKLIN CO.: Ozark Natl. Forest, Bee Rock, on rock, *Ladd* 25883A (HB. LADD); Ozark Natl. Forest, along Hurricane Creek near Shores Lake, *Morse 12049* (KANU); GREENE CO.: Crowley's Ridge State Park, *Ladd 16009B* (HB. LADD); HOT SPRING CO.: DeGray Lake State Park, *Ladd 15651* (HB. LADD); IZARD CO.: NE corner of Devil's Knob-Devil's Backbone Natural Area, *Buck 40233* (NY); JEFFERSON CO.: Pine Bluff Arsenal along south side of Arkansas River, *Ladd 21777* (NY), *Ladd 21871* (NY), *Ladd 22039* (NY); MADISON CO.: Withrow Springs State Park, along War Eagle Creek, *Ladd 14804* (HB. LADD); PIKE CO.: Wooded novaculite bluffs north of Langley, *Ladd 14944* (HB. LADD); POPE CO.: Ozark Natl. Forest, Kings Bluff, on rock, *Ladd 27469* (NY, HB. LADD); PRAIRIE CO.: Wattensaw Wildlife Mgmt. Area, *Ladd 18530* (HB. LADD); SHARP CO.: Strawberry River Preserve, *Harris 45583* (NY); STONE CO.: Ozark Natl. Forest, Blanchard Springs Recreation Area, *Ladd 15393* (HB. LADD); VAN BUREN CO.: Ozark Natl. Forest, Upper Brock Creek Campground, *Ladd 28190* (HB. LADD). **FLORIDA**.

Alachua Co.: Paynes Prairie State Preserve, Bolens Bluff Trail, *Harris 29464* (NY); Bay Co.: N of Fla. Hwy. 20, 1.2 mi E of U.S. Hwy. 231, *Harris 35746* (NY); Calhoun Co.: W of St. Rd. 71. 6.6 mi N of Gulf County line, *Harris 32173* (NY); Citrus Co.: Withlacoochee State Forest, *Harris 31827* (NY); Clay Co.: Gold Head Branch State Park, *Harris 29092* (NY); Collier Co.: Big Cypress Natl. Preserve, *Harris 30192* (NY); Dade Co.: Royal Palm Hammock, *Small 7596* (NY); Columbia Co.: along Fla. Hwy. 250, ca. 0.5 mi S of I-10, *Harris 26252* (NY); Dixie Co.: Steinhatchee Wildlife Management Area, *Harris 31590* (NY); Hamilton Co.: Bee Haven Bay, N of Co. Rd. 6, E of Jasper, *Harris 32490* (NY); Hendry Co.: Along CR 78, 0.6 mi W of SR 29 at LaBelle, *Buck 33879* (NY); Highlands Co.: Archbold Biological Station, *Buck 33684* (NY); Holmes Co.: E of Co. Rd. 177A, 4 mi NW of St. Rd. 79 in Bonifay, *Harris 32095* (NY); Lafayette Co.: Along Co. Rd. 355A, 1.4 mi SE of Fla. Hwy. 51, *Harris 35804* (NY); Leon Co.: Leon Sinks Geological Area, *Harris 23275* (NY); Levy Co.: along Fla. Hwy. 24 ca. 6 mi NE of jct. with U.S. Alt 27 at Bronson, *Harris 29308* (NY); Manatee Co.: Duette Park, *Harris 42079* (NY); Marion Co.: Ocala, *Underwood 1845* (NY); Orange Co.: Tosohatchee State Reserve, *Harris 37513* (NY); Osceola Co.: Bull Creek Wildlife Management Area, *Harris 37558* (NY); Polk Co.: Bok Tower Gardens, *Wheeler s.n.* (NY); Seminole Co.: along Econlockhatchee River at Little-Big Econlockhatchee Canoe Launch, *Harris 37721* (NY); Sumter Co.: Withlacoochee State Forest, Jumper Creek, *Harris 39839* (NY); Taylor Co.: Big Bend Wildlife Management Area, *Harris 39532* (NY); Union Co.: Worthington Springs, *Harris 35947* (NY); Volusia Co.: South Tomoka Wildlife Mgmt. Area, *Buck 28935* (NY). **GEORGIA**. Baker Co.: Ichuaway Plantation/Jones Ecological Research Center, on rock, *Lendemer 9513* (NY), *Lendemer 9568* (NY), *Lendemer 9583* (NY); Clarke Co.: East Athens, *Harris 28935A* (NY); Coffee Co.: Broxton Rocks Ecological Preserve, *Harris 38729* (NY); Columbia Co.: Heggie's Rock Preserve, *Harris 43520* (NY); Early Co.: Williams Bluff Preserve, *Lendemer 9343* (NY); Greene Co.: Oconee Natl. Forest, end of Forest Service Road 1202, *Harris 38872* (NY); Rockdale Co.: Panola Mountain State Park, *Lendemer 8954* (NY); Towns Co.: Reed Branch Wet Meadow TNC Preserve, *Lendemer 10323-A* (NY); Walker Co.: Chattahoochee Natl. Forest, Johns Mountain Overlook, *Harris 28205* (NY). **INDIANA**. Putnam Co.: Hoosier Highlands, *Zanoni 122-38* (NY). **KANSAS**. Chautauqua Co.: Along Birch Creek E of Rd. 29, *Morse 15695* (KANU); Cowley Co.: Chaplin Nature Center in Arkansas City, *Morse 10707* (KANU); Douglas Co.: University of Kansas Breidenthal Biological Reserve, *Adviata 1252* (KANU), *Adviata 1258* (KANU); Miami Co.: North La Cygne State Fishing Lake and Wildlife Area, *Morse 11304* (KANU); Montgomery Co.: Elk City Lake, west of Memorial Lookout, *Morse 14591* (KANU); **KENTUCKY**. Nelson Co.: Bernheim Arboretum and Research Forest, *Ladd 23983* (NY); Whitley Co.: Cumberland Falls, *Allen 74* (NY). **MARYLAND**. Worcester Co.: Hickory Point Cypress Swamp, *Lendemer 6345* (NY). **MASSACHUSETTS**. Cambridge, *Tuckerman s.n.* (NY). **MICHIGAN**. Marquette Co.: Huron Mountain Club, Salmon Trout River, *Manierre L-450* (NY); Washtenaw Co.: Crooked Lake, Waterloo Recreation Area, *Buck s.n.* (NY). **MINNESOTA**. Cass Co.: Ottertail Peninsula in Leech Lake, *Buck B517* (NY); St. Louis Co.: Voyageurs Natl. Park, S side of Old Dutch Bay, *Wetmore 31263* (NY). **MISSOURI**. Barry Co.: Mark Twain Natl. Forest, Piney Creek Wilderness, *Lendemer 6485* (NY); Roaring River State Park, *Buck 38848* (NY), *Ladd 13094* (HB. LADD); Boone Co.: Southeast of Sapp, along tributary of Fox Hollow Branch, *Ladd 12620* (HB. LADD); Butler Co.: Allred Lake Natural Area, *Harris 45289* (NY); Carter Co.: MOFEP site 9, in Peck Ranch Conservation Area, *Ladd 20524* (HB. LADD); Christian Co.: Mark Twain Natl. Forest, S of Chadwick Road at jct. of Monarch road, *Buck 44541* (NY); Crawford Co.: Vilander Bluff Natural Area, *Harris 50099* (NY); Dallas Co.: Bennett Spring State Park, *Ladd 5699* (HB. LADD), *Ladd 6218* (HB. LADD); Dent Co.: Hyer Woods Preserve, *Ladd 12349* (HB. LADD); Montauk State Park, *Ladd 26492* (HB. LADD); Douglas Co.: Hunter Creek Glade, ca. 6.5 miles E/SE of Ava, *Ladd 25991* (HB. LADD); Howell Co.: Three miles N of Brandsville, *Summers 3145* (HB. LADD); Iron Co.: Munger Shut-Ins, along East Fork Black River, *Ladd 17664* (HB. LADD); Jefferson Co.: LaBarque Hills Preserve, *Ladd 12973* (HB. LADD); Lawrence Co.: Fall Hollow Gorge, on rock, *Ladd 27727* (HB. LADD); Madison Co.: Rhodes Mountain, *Ladd 10529* (HB. LADD); Maries Co.: Spring Creek Gap Conservation Area, *Harris 46597* (NY); Oregon Co.: Falling Springs Mill, *Summers 2519* (NY); McDonald Co.: Huckleberry Ridge Conservation Area, *Buck 38404* (NY); Oregon Co.: Low woods along Eleven Point River at Cave Bluff, *Summers 2492* (HB. LADD); Ozark Co.: Caney Mountain Conservation Area, *Buck 36036* (NY); Pulaski Co.: Dolomite bluff along Gasconade River, near terminus of hwy Y, *Ladd 12566* (HB. LADD); Ripley Co.: Mark Twain Natl. Forest, Cupola Pond Natural Area, *Ladd 12262* (HB. LADD); Shannon Co.: Ozark Natl. Scenic Riverways, vicinity of Rocky Falls, *Buck 18153* (NY); Ozark Natl. Scenic Riverways, along Current River 1 mile NW of Owls Bend, *Ladd 17898* (HB. LADD); Ozark Natl. Scenic Riverways, Prairie Hollow Gorge Natural Area, *Nigh 1199* (HB. LADD); MOFEP site 4, in Peck Ranch Conservation Area, *Chadwell 64* (KANU); Stone Co.: Ashe Juniper Natural Area, *Buck 42855*(NY); dolomite bluff along James river 1.5 miles southwest of Janesville,

Ladd 12447 (HB. LADD); TANEY CO.: Mark Twain Natl. Forest, Hercules Glade Wilderness, *Buck 44492* (NY). **MISSISSIPPI**. SCOTT CO.: Bienville Natl. Forest, *Harris 28738* (NY). **NEW YORK**. WASHINGTON CO.: Shushan, *Burnham s.n.* (NY). **NORTH CAROLINA**. BUNCOMBE CO.: 5 mi N of Ashville, *Voth 121* (NY); CLAY CO.: Nantahala Natl. Forest, Buck Creek Barren, *Lendemer 10768-A* (NY); HAYWOOD CO.: Great Smoky Mtns. Natl. Park, 3 mi SE of Waterville, along Baxter Creek Tail, *Lendemer 8182* (NY); JACKSON CO.: Cedar Cliff Mountain, *Harris 42775* (NY); PASQUOTANK CO.: 4-5 mi N of Elizabeth City, *Reed 66090* (NY); ORANGE CO.: Mason Farm Biological Preserve, *Perlmutter 866* (NY), *Perlmutter 981* (NY), *Perlmutter 1030* (NY); PENDER CO.: Holly Shelter Game Land, *Brodo 31134* (CANL), *Lendemer 8428* (NY); WAKE CO.: William B. Umstead State Park, *Lendemer 8300* (NY), *Lendemer 8360* (NY). **OHIO**. GALLIA CO.: Wayne Natl. Forest, above Symmes Creek, *Lendemer 7388* (NY). **OKLAHOMA**. CADDO CO.: Red Rock Canyon State Park, *Morse 14837* (KANU), *Morse 14871* (KANU); CHEROKEE CO.: Cookson Wildlife Management Area, Bolin Hollow, *Harris 49022* (NY); W of Blue Top Road, *Harris 48905* (NY), *Ladd 25645* (HB. LADD); J.T. Nickle Family Preserve, 7 mi. NE Talequah, *Ladd 22390* (HB. LADD); OSAGE CO.: Woolaroc Wildlife Preserve, *Morse 14892* (KANU); SEQUOYAH CO.: Sallisaw-Brushy Lake State Park, *Buck 38669*, on rock, *Ladd 22482B* (HB. LADD); **PENNSYLVANIA**. Pike Co.: Delaware Water Gap Natl. Recreation Area, Childs Recreation Area, *Lendemer 3409* (NY). **SOUTH CAROLINA**. ABBEVILLE CO.: Sumter Natl. Forest, Parsons Mountain, *Harris 40331* (NY); LANCASTER CO.: Forty Acre Rock, *Harris 40187* (NY); LEXINGTON CO.: Peachtree Rock Nature Preserve, *Harris 39925* (NY); NEWBERRY CO.: Sumter Natl. Forest, Buncombe Trail, *Harris 40136* (NY); PICKENS CO.: along Eastatoe Creek ca. 2.5 mi SW of town of Rocky Bottom, *Harris 24780* (NY); SUMTER CO.: Manchester State Forest, *Harris 40230* (NY). **TENNESSEE**. PERRY CO.: Jennings Bluff along Tennessee River, *Ladd 14081* (HB. LADD). **TEXAS**. HARDIN CO.: Saratoga, *Fie s.n.* (NY); HOUSTON CO.: Mission State Park, *Wetmore 17671* (NY); KENEDY CO.: 48 mi N of Raymondville, *Pursell 5922* (NY); TRAVIS CO.: Bear Creek, *Ferguson s.n.* (NY); TYLER CO.: Big Thicket Natl. Preserve, 5 mi SE of Warren, *Egan 8042* (NY); UVALDE CO.: Winston Ranch, 6 miles S. of Sabinal, *Morse 9204* (KANU). **VIRGINIA**. SHENANDOAH CO.: along state route 675 at Edinburg Gap, *Guccion 1060* (NY); **WEST VIRGINA**. PENDLETON CO.: Monongahela Natl. Forest, Fanny Bennett Hemlock Grove, *Ladd 22753* (HB. LADD); POCAHONTAS CO.: Watoga State Park, Riverside Campground Area, *Harris 43937* (NY), *Lendemer 9820* (NY). **WISCONSIN**. ONEIDA CO.: Patterson Hemlocks State Natural Area, *Buck 41811* (NY).

Chrysothrix sp.

DESCRIPTION. - Morphologically essentially as in *C. xanthina*. **Chemistry**: K± reddish, KC± reddish, C–, PD–, UV–; calycin or calycin (major) + pinastric acid (minor). **Granules** 25-45(-65) µm across (averages 33-37.5 µm). **Apothecia** (Cuba, *Hioram 5771* [NY]) arthonioid, semi-immersed, yellow pruinose, ca. 0.1-0.2 mm across; spores 3-septate, ca. 12.5-15 x 3-4 µm. **Pycnidia** not seen.

DISCUSSION. - Some corticolous specimens from the southeast United States and the Caribbean resemble *C. xanthina* but have small soredia and calycin as the major substance. The ultimate disposition of this material can probably only be determined with molecular data. We are not aware of an available name nor are we prepared at this time to slog through the extensive list of synonyms for *C. candelaris*. A poor specimen (*Worthley L-633*) is included here, even though the granule size (42-65 µm wide) approaches that of *C. candelaris*, since distribution suggests it belongs with this apparently subtropical taxon and *C. candelaris* is otherwise unknown in eastern North America.

Most collections are from *Quercus*, particularly live oaks (*Q. geminata/Q. minima/Q. virginiana* complex), but this entity occurs less commonly on other hardwood trees and shrubs, as well as a single collection from a dead *Pinus*.

SPECIMENS EXAMINED. - **BAHAMAS**. ANDROS: Barton Creek, *Brace 5297* (as *Bilimbia aurata*) (NY). **CUBA**. Confianza Estate, *Hioram 5771* (NY). **UNITED STATES**. **ALABAMA**. CALHOUN CO.: Fort McClellan, *Worthley L-633* (NY). **FLORIDA**. DUVAL CO.: Jacksonville Beach, *Buck B160* (NY); ESCAMBIA CO.: Gulf Island National Seashore, Santa Rosa Island, *Guarisco 55* (KANU); FRANKLIN CO: St. George Island State Park, *Ladd 14579* (HB. LADD); HIGHLANDS CO.: Archbold Biological Station, *Harris 41773* (NY); LIBERTY CO.: Torreya State Park, *Ladd 14600* (HB. LADD); POLK CO.: Tiger Creek Preserve, *Wheeler s.n.* (NY); TAYLOR CO.: Along C.R. 361, 1.7 mi N of Keaton Beach, *Buck 31154* (NY); WAKULLA CO.: Ochlockonee River State Park, *Ladd 14442* (HB. LADD). **GEORGIA**. HEARD CO.: Camp Meeting Rock Preserve, *Harris 43313* (NY); JEFF DAVIS CO.: 0.4 mi E of Coffee Co. line on Georgia Hwy 107, *Harris 36189* (NY).

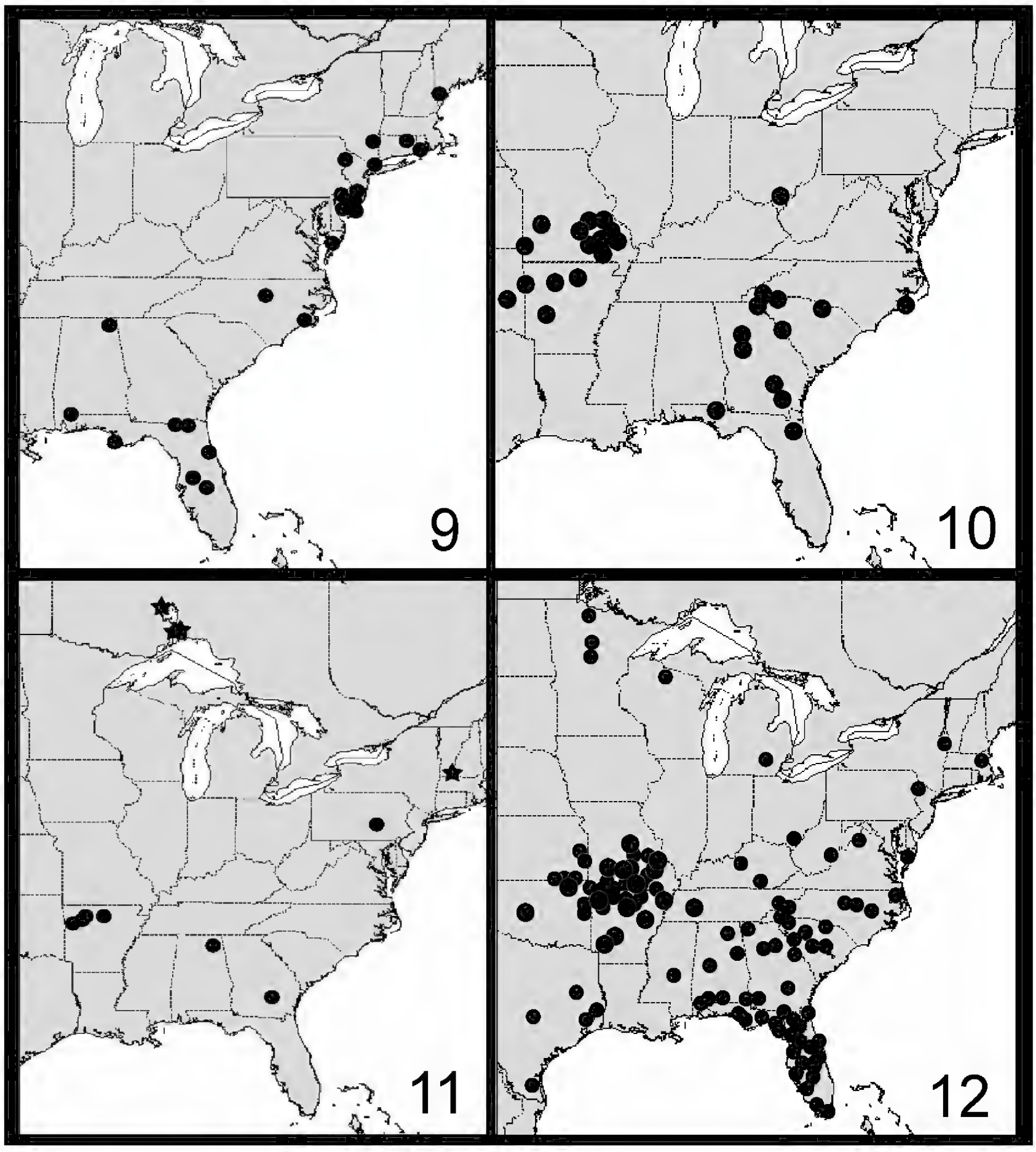

Plate 3. Figure 9. Eastern North American distribution of *C. flavovirens*. **Figure 10.** Eastern North American distribution of *C. insulizans*. **Figure 11.** Eastern North American distribution of *C. chlorina* (stars) and *C. onokoensis* (dots). **Figure 12.** Eastern North American distribution of *C. xanthina*.

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Contributions to the Lichen Flora of Alabama: Recent Collections from Four Counties

Curtis J. Hansen[1], James C. Lendemer[2] & Sean Q. Beeching[3]

ABSTRACT. – Results from recent collecting activites in Baldwin, Cherokee, Dekalb, and Escambia Counties, Alabama, USA, are presented. A checklist of 208 lichens and lichenicolous fungi is provided, including 39 taxa that are reported new to the state.

Introduction

Recent lichen collections from Baldwin, Cherokee, Dekalb, and Escambia Counties, Alabama, are compiled into a checklist that includes several new state records as well as other interesting finds. Collectors who have been working in Alabama in 2007 and contributed to this list include, W.R. Buck (New York Botanical Garden), S. Beeching (Atlanta, Georgia), C.J. Hansen (Auburn University), R.C. Harris (New York Botanical Garden), M. Hodges (The Nature Conservancy, Georgia) and J.C. Lendemer (New York Botanical Garden). A list of collectors and the corresponding herbarium acronym where their collections are deposited is as follows: S. Beeching (hb-Beeching), W.R. Buck (NY), C.J. Hansen (AUA), R.C. Harris (NY), M. Hodges (hb-Hodges), and J.C. Lendemer (PH, duplicates in NY). Participants identified their own specimens and collections were not confirmed by any one individual.

Checklist

Individual specimens are listed in alphabetical order followed by the county and the collector name(s) and number(s) of those who obtained vouchers. Nomenclature does not exclusively follow Esslinger (1997) but occasionally reflects a determiner's preference.

+ = new state record based on Hansen (2003), Hansen and Dute (2005), & Hansen and Lendemer (in press).
* = lichenolicolous fungi

Amandinea polyspora (Willey) E. Lay & P. May – Escambia: *Buck 51742.*
Anisomeridium polypori (Ellis & Everh.) M. E. Barr – Escambia: *Beeching 2667.*
+*Arthonia albovirescens* Nyl. – Baldwin: *Buck 51606, Lendemer 9031;* Escambia: *Harris 53371.*
+*Arthonia dryadum* R.C. Harris & Ladd ined. – Escambia: *Buck 51660.*
+*Arthonia quintaria* Nyl. – Escambia: *Buck 51687, Lendemer 9159.*
Arthonia rubella (Fée) Nyl. – Baldwin: *Buck 51592.*
Arthopyrenia cinchonae (Ach.) Müll. Arg. – Baldwin: *Lendemer 9038*; Escambia: *Buck 51654, Harris 53345, Lendemer 9258*
+*Arthopyrenia taxodii* R.C. Harris – Escambia: *Buck 51714.*

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Arthothelium interveniens (Nyl.) Zahlbr. – Baldwin: *Hansen 2878*, *Harris 53254*; Escambia: *Harris 53350, Lendemer 9175.*

Bacidia heterochroa (Müll. Arg.) Zahlbr. – Baldwin: *Harris 53280*; Escambia: *Buck 51696, Lendemer 9376.*

Bacidia schweinitzii (Fr. *ex* E. Michener) G. Schneid. – Baldwin: *Buck 51588, Harris 53249, Lendemer 9061*; Escambia: *Beeching 2689, Hansen 2966, Lendemer 53383*.

Bacidia suffusa (Fr.) A. Schneid. – Escambia: *Beeching 2705*.

Bathelium carolinianum (Tuck.) R.C. Harris – Baldwin: *Beeching 2638, Buck 51644, Hansen 2880*, *Harris 53237, Hodges 1425*; Escambia: *Buck 51668, Hansen 2969, Harris 53363, Lendemer 9178.*

Brigantiaea leucoxantha (Spreng.) R. Sant. & Hafellner – Baldwin: *Buck 51642, Harris 53338, Lendemer 9024*; Escambia: *Buck 51690, Hansen 2964.*

Buellia elizae Tuck. – Baldwin: *Buck 51575*; Escambia: *Harris 53400.*

Buellia imshaugiana Hafellner – Baldwin: *Buck 51573.*

+*Buellia rubifaciens* R.C. Harris – Baldwin: *Harris 53244*; Escambia: *Hansen 2985*

Buellia stillingiana J. Steiner – Baldwin: *Hansen 2881, Harris 53257*; Escambia: *Buck 51650, Hansen 2952, Harris 53354*, *Hodges 1462, Lendemer 9166*

Bulbothrix goebelii (Zenker) Hale – Baldwin: *Beeching 2643*; *Harris 53274.*

Bulbothrix laevigatula (Nyl.) Hale – Baldwin: *Beeching 2636, Lendemer 9060*; Escambia: *Harris 53364.*

Byssoloma leucoblepharum (Nyl.) Vainio – Baldwin: *Buck 51559*; Escambia: *Beeching 2665, Lendemer 9252.*

Byssoloma meadii (Tuck.) S. Ekman – Baldwin: *Beeching 2626, Buck 51561, Hodges 1417*; Escambia *Buck 51691, Hansen 2942, Harris 53341, Lendemer 9153.*

Caloplaca cerina (Ehrh. *ex* Hedw.) Th. Fr. – Escambia: *Beeching 2725, Hansen* 2979, *Lendemer 9379.*

Canoparmelia caroliniana (Nyl.) Elix & Hale – Baldwin: *Harris 53233, Lendemer 9042*; Escambia: *Harris 53343, Lendemer 9237.*

Canoparmelia cryptochlorophaea (Hale) Hale – Baldwin: *Harris 53332;* Escambia: *Beeching 2691, Hansen 2977, Harris 53370.*

Canoparmelia texana (Tuck.) Elix & Hale – Escambia: *Lendemer 9381.*

+*Carbacanthographis marescens* (Fée) Staiger & Kalb – Baldwin: *Beeching 2619.*

+*Chrysothrix flavovirens* Tønsberg s. lat. – Baldwin: *Hansen 2915, Lendemer 9062*

+*Chrysothrix xanthina* (Vainio) Kalb – Baldwin: *Harris 53333*; Escambia: *Hansen 2957*, *Lendemer 9155.*

Cladonia beaumontii (Tuck.) Vainio – Baldwin: *Harris 53327.*

Cladonia coniocraea (Flörke) Sprengel – Baldwin: *Hodges 1418.*

Cladonia cristatella Tuck. – Baldwin: *Beeching 2617*; Escambia: *Hansen 2980, Harris 53353.*

Cladonia didyma (Fée) Vainio – Baldwin: *Hodges 1411, Lendemer 9074.*

Cladonia didyma var. *vulcanica* (Zoll. & Moritzi) Vainio – Baldwin: *Beeching 2616, Hansen 2872*, *Harris 53235*; Escambia: *Harris 53362.*

Cladonia grayi G. Merr. *ex* Sandst. – Baldwin: *Lendemer 9076,* Escambia: *Harris 53397.*

Cladonia leporina Fr. – Baldwin: *Lendemer 9075*; Escambia: *Beeching 2655, Hansen 2945.*

Cladonia macilenta var. *bacillaris* (Genth) Schaer. – Escambia: *Harris 53403.*

Cladonia peziziformis (With.) J.R. Laundon – Escambia: *Hansen 2946.*

Cladonia piedmontensis G. Merr. – Baldwin: *Lendemer 9073.*

Cladonia polycarpia G. Merr. – Baldwin: *Lendemer 9064*; Escambia: *Buck 53349, Hansen 2939, Harris 51649, Lendemer 9370.*

Cladonia strepsilis (Ach.) Grognot – Baldwin: *Harris 53239*; Escambia: *Hansen 2981.*

Cladonia subradiata (Vainio) Sandst. – Baldwin: *Harris 53251, Lendemer 9040.*

Cladonia subtenuis (Abbayes) Mattick – Baldwin: *Hodges 1427*; Escambia: *Hansen 2983.*

Coccocarpia palmicola (Sprengel) Arv. & D.J. Galloway – Escambia: *Hansen 2958, Lendemer 9261*; Baldwin: *Hodges 1416.*

Coccocarpia stellata Tuck. – Baldwin: *Beeching 2644, Hodges 1416, Lendemer 9047.*

Coenogonium lutea (Dicks.) Lücking & Kalb – Baldwin: *Beeching 2606.*

+*Coniarthonia pyrrhula* (Nyl.) Grube – Baldwin: *Lendemer 9025.*

Crocynia pyxinoides Nyl. – Baldwin: *Beeching 2646* (fertile), *Hodges 1424, Lendemer 9067.*

Cryptothecia rubrocincta (Ehrenb.) G. Thor – Baldwin: *Beeching 2609, Buck 51617, Hansen 2873Hodges, 1430, Lendemer 9052*; Escambia: *Beeching 2672, Buck 51685, Harris 53359.*

Dirinaria aegialita (Afz.) B. Moore – Baldwin: *Beeching 2618.*

Dirinaria confusa D. D. Awasthi – Baldwin: *Hansen 2902*, *Harris 53290.*
Dirinaria picta (Sw.) Schaer. ex Clem. – Baldwin: *Lendemer 9034.*
Dyplolabia afzelii (Ach.) A. Massal. – Baldwin: *Buck 51563, Hansen 2876*, *Harris 53336, Hodges 1430, Lendemer 9050;* Escambia: *Beeching 2687, Lendemer 9151.*
Fissurina columbina (Tuck.) Staiger – Baldwin: *Buck 51570, Hansen 2875*; Escambia: *Harris 53351, Hodges 1434.*
Fissurina cypressi (Müll. Arg.) Lendemer – Baldwin: *Beeching 2611, Hodges 1419, Lendemer 9078.*
Fissurina illiterata (R.C. Harris) Lendemer – Escambia: *Beeching 2666.*
Fissurina insidiosa C. Knight & Mitten – Baldwin: *Beeching 2613*; Escambia: *Buck 51670.*
+*Fissurina scolecitis* (Tuck.) Lendemer – Baldwin: *Hodges 1426, Lendemer 9049.*
Flavoparmelia caperata (L.) Hale – Escambia: *Beeching 2721.*
Glyphis cicatricosa Ach. – Escambia: *Hansen 2951*, *Harris 53352, Lendemer 9238.*
+*Graphis furcata* Fée – Baldwin: *Buck 51615*; Escambia: *Buck 51734.*
Graphis inversa R.C. Harris – Baldwin: *Harris 53236.*
Graphis lucifica R.C. Harris – Baldwin: *Lendemer 9027*; Escambia *Buck 51681, Hodges 1442, Lendemer 9181.*
Graphis scripta (L.) Ach. – Escambia: *Beeching 2654.*
Graphis subelegans Nyl. – Baldwin: *Beeching 2641.*
+*Gyalideopsis buckii* Lücking, Sérus. & Vězda – Escambia: *Beeching 2726, Buck 51663, Hansen 2950, Lendemer 9177.*
+*Gyalideopsis ozarkana* Lücking & W.R. Buck – Cherokee: *Beeching 3205.*
Gyrostomum scyphuliferum (Ach.) Nyl. – Baldwin: *Hodges 1437.*
Haematomma flexuosum Hillm. – Baldwin: *Hansen 2901, Lendemer 9033*; Escambia: *Lendemer 9256.*
Hafellia bahiana (Malme) Sheard – Escambia: *Buck 51653.*
Hafellia curatellae (Malme) Marbach – Escambia: *Buck 51680.*
+*Hafellia pleiotera* (Malme) Marbach – Escambia: *Buck 51669.*
+*Halecania pepegospora* (H. Magn.) van den Boom – Dekalb: *Beeching 3141.*
Heterodermia albicans (Pers.) Swinsc. & Krog – Baldwin: *Buck 51586, Harris 53282*; Escambia: *Buck 51739-A*, *Hodges 1436.*
+*Heterodermia crocea* R.C. Harris – Baldwin: *Hodges 1423, Lendemer 9041.*
Heterodermia echinata (Taylor) W.L. Culb. – Escambia: *Beeching 2733, Buck 51719, Hansen 2974, Hodges 1467, Lendemer 9388.*
Heterodermia obscurata (Nyl.) Trevisan – Baldwin: *Beeching 2623, Hansen 2928*; Escambia: *Beeching 2734, Buck 51657, Hansen 2963, Harris 53389, Hodges 1461.*
Heterodermia speciosa (Wulfen) Trevisan – Baldwin: *Hansen 2989.*
+*Hypotrachyna afrorevoluta* (Swinsc. & Krog) Swinsc. & Krog – Escambia: *Lendemer 9246.*
Hypotrachyna livida (Taylor) Hale – Baldwin: *Hansen 2899*, *Harris 53277, Lendemer 9029*; Escambia: *Beeching 2653, Harris 53396, Hodges 1436, Lendemer 9160.*
Hypotrachyna osseoalba (Vainio) Park & Hale – Baldwin: *Hansen 2874*, *Harris 53240*; Escambia: *Hansen 2949*, *Hodges 1443, Lendemer 9154.*
Lecanora chlarotera Nyl. – Escambia: *Harris 53346.*
Lecanora cupressi Tuck. – Baldwin: *Buck 51577, Hansen 2886.*
Lecanora hybocarpa (Tuck.) Brodo – Escambia: *Buck 51674, Buck 51676, Hansen 2956, Harris 53410, Hodges 1442, Lendemer 9147.*
Lecanora imshaugii Brodo – Escambia: *Beeching 2681, Hansen 2960*(?).
Lecanora louisianae de Lesd. – Baldwin: *Buck 51611, Hansen 2887, Harris 53264, Hodges 1437*; Escambia: *Buck 51736, Hansen 2947, Harris 53382, Lendemer 9148.*
+*Lecanora miculata* Ach. – Baldwin: *Buck 51620*; Escambia: *Beeching 2720, Buck 51707, Lendemer 9378.*
Lecidella euphorea (Flörke) Hertel – Escambia: *Buck 51696-A*.
+*Leioreumma explicans* (Fink) Lendemer – Escambia: *Buck 51705, Harris 53344.*
+*Leiorreuma sericeum* (Eschw.) Staiger – Baldwin: *Buck 51661, Hansen 2885*; Escambia: *Beeching 2688, Harris 53402*
+*Lepraria friabilis* Lendemer, K. Knudsen & Elix – Baldwin: *Beeching 2601, Hodges 1428, Lendemer 9063.*
Lepraria lobificans Nyl. – Escambia: *Harris 53361, Lendemer 9158.*

Leptogium cyanescens (Rabenh.) Körber – Baldwin: *Buck 51597, Hansen 2917, Harris 53314*; Escambia: *Beeching 2686, Hansen 2968*, *Harris 51692, Lendemer 9371.*
Leptogium marginellum (Sw.) Gray – Escambia: *Beeching 2713.*
Lobaria tenuis Vainio – Escambia: *Beeching 2710, Hodges 1470.*
Maronea polyphaea H. Magn. – Escambia: *Buck 51700, Lendemer 9377.*
+*Mazosia ocellata* (Nyl.) R.C. Harris – Baldwin: *Buck 51622, Harris 53319.*
Megalospora pachycheila (Tuck.) Sipman – Baldwin: *Harris 53255, Lendemer 9065*; Escambia: *Lendemer 9146.*
Megalospora porphyrites (Tuck.) R.C. Harris – Baldwin: *Beeching 2649.*
Micarea erratica (Körber) Hertel et al. – Escambia: *Beeching 2671, Buck 51662, Hansen 2941.*
Micarea neostipitata Coppins & P. May – Baldwin: *Lendemer 9059.*
Micarea prasina Fr. – Baldwin: *Lendemer 9058.*
**Minutoexcipula tuckerae* V. Atienza & D. Hawksw. – Baldwin: *Buck 51603* (on *Pertusaria texana*).
+*Mycocalicium subtile* (Pers.) Szatala – Escambia: *Buck 51648, Lendemer 9250.*
Mycoporum eschweileri (Müll. Arg.) R.C. Harris – Baldwin: *Buck 51604*; Escambia: *Buck 51686.*
Mycoporum lacteum (Ach.) R.C. Harris – Escambia: *Buck 51664.*
Myelochroa aurulenta (Tuck.) Elix & Hale – Baldwin: *Beeching 2631.*
Nadvornikia sorediata R.C. Harris – Baldwin: *Buck 51609, Harris 53313.*
Ocelluaria americana Hale – Baldwin: *Hansen 2877.*
Ocellularia sanfordiana (Zahlbr.) Hale – Baldwin *Beeching 2610, Buck 51569, Harris 53256, Hodges 1420, Lendemer 9030*; Escambia: *Beeching 2706, Lendemer 9180.*
Ochrolechia africana Vainio – Escambia: *Harris 53340, Lendemer 9231.*
Opegrapha varia Pers. – Baldwin: *Hansen 2920.*
Opegrapha viridis (Pers. ex Ach.) Behlen & Desberger – Baldwin: *Beeching 2612, Buck 51622A, Harris 53247*; Escambia: *Lendemer 9372.*
Opegrapha vulgata Ach. – Baldwin: *Buck 51605, Harris 53315.*
Parmelinopsis horrescens (Taylor) Elix & Hale – Baldwin: *Beeching 2642*; Escambia: *Hodges 1443.*
Parmelinopsis minarum (Vainio) Elix & Hale – Baldwin: *Hansen 2933*; Escambia: *Hansen 2940, Lendemer 9232.*
Parmelinopsis spumosa (Asahina) Elix & Hale – Escambia: *Hansen 2984.*
+*Parmotrema dilatatum* (Vainio) Hale – Baldwin: *Beeching 2628, Harris 53323*; Escambia: *Beeching 2674.*
Parmotrema gardneri (C.W. Dodge) Hale – Baldwin: *Lendemer 9068.*
+*Parmotrema hypoleucinum* (Steiner) Hale – Baldwin: *Hansen 2882.*
Parmotrema hypotropum (Nyl.) Hale – Baldwin: *Hansen 2891, 2900, Harris 53263, Hodges 1439*; Escambia: *Harris 53367.*
Parmotrema mellissii (C.W. Dodge) Hale – Baldwin: *Hansen 2938*; Escambia: *Beeching 2692, Hansen 2954, Harris 53375.*
Parmotrema perforatum (Jacq.) A. Massal. – Escambia: *Beeching 2724, Harris 53388, Hodges 1466, Lendemer 9373.*
Parmotrema praesorediosum (Nyl.) Hale – Baldwin: *Harris 53266*; Escambia: *Hansen 2987*, *Harris 53407.*
Parmotrema reticulatum (Taylor) M. Choisy – Baldwin: *Beeching 2633, Harris 5325;* Escambia: *Beeching 2673, Harris 53380.*
Parmotrema subisidiosum (Müll. Arg.) Hale – Baldwin: *Hansen 2890, Harris 53289*; Escambia: *Hansen 2975, Hodges 1445.*
Parmotrema submarginale (Michx.) DePriest & B. Hale – Baldwin: *Hansen 2907*, *Harris 53261*; Escambia *Beeching 2684, Lendemer 9247.*
Parmotrema tinctorum (Delise ex Nyl.) Hale – Baldwin: *Hansen 2903, Harris 53248, Lendemer 9046*; Escambia: *Harris 53378, Lendemer 9174.*
Peltigera praetextata (Flörke ex Sommerf.) Zopf – Escambia: *Beeching 2716.*
Pertusaria commutata Müll. Arg. – Baldwin: *Buck 51599, Harris 53325*; Escambia: *Buck 51703, Harris 53394.*
Pertusaria copiosa Erichsen – Baldwin: *Hansen 2905*; Escambia: *Beeching 2728.*
Pertusaria epixantha R.C. Harris – Baldwin: *Buck 51593*; Escambia: *Lendemer 9179.*
Pertusaria neoscotica I.M. Lamb – Baldwin: *Harris 53286.*

Pertusaria paratuberculifera Dibben – Baldwin: *Buck 51591.*
Pertusaria pustulata (Ach.) Duby – Escambia: *Lendemer 9383.*
Pertusaria sinusmexicani Dibben – Escambia: *Buck 51726.*
Pertusaria subpertusa Brodo – Baldwin: *Buck 51624, Hansen 2884.*
Pertusaria tetrathalamia (Fée) Nyl. – Baldwin: *Hansen 2896, Harris 53294;* Escambia: *Buck 51739, Harris 53386, Lendemer 9387.*
Pertusaria texana Müll. Arg. – Baldwin: *Beeching 2624, Harris 53281*; Escambia: *Buck 51730, Hansen 2943, Lendemer 9235, 9393.*
Pertusaria trachythallina Erichsen – Baldwin: *Harris 53252* (lichexanthone chemotype); Escambia: *Buck 51701, Hodges 1440, Lendemer 9244.*
Pertusaria velata (Turner) Nyl. – Baldwin: *2607, Harris 53335* (UV+), *Lendemer 9028* (UV-), *9039* (UV).
Phaeographis erumpens (Nyl.) Müll. Arg. – Escambia: *Buck 51655.*
Phaeophyscia ciliata (Hoffm.) Essl. – Escambia: *Beeching 2732, Hansen 2986, Hodges 1459, Lendemer 9363.*
Phaeophyscia rubropulchra (Degel.) Essl. – Escambia: *Beeching 2731, Hodges 1460.*
+**Phaeosporobolus alpinus* R. Sant., Alstrup & D. Hawksw. – Escambia: *Buck 51688* (on *Pertusaria epixantha*).
Phlyctis ludoviciensis (Müll. Arg.) Lendemer – Baldwin *Beeching 2614, Hansen 2913*; *Harris 53300, Lendemer 9022*; Escambia *Hansen 2953, Harris 53369, Lendemer 9168.*
Phyllopsora confusa Swinscow & Krog – Baldwin: *Harris 53211.*
Phyllopsora corallina (Eschw.) Müll. Arg. – Baldwin: *Lendemer 9035*; Escambia: *Lendemer 9234.*
Physcia americana G. Merr. – Escambia: *Beeching 2736, Hodges 1465, Lendemer 9390.*
Physcia atrostriata Moberg – Escambia: *Harris 53355, Hodges 1459, Lendemer 9262.*
Physcia neogaea R.C. Harris – Baldwin: *Harris 53275.*
Physcia pumilior R.C. Harris – Baldwin: *Hansen 2910,* Escambia: *Beeching 2719, Hodges 1462, Lendemer 9389.*
Physcia sorediosa (Vainio) Lynge – Baldwin: *Hansen 2895*, *Harris 53272*; Escambia: *Beeching 2730.*
+*Piccolia ochrophora* (Nyl.) Hafellner – Escambia: *Buck 51727.*
+*Placynthiella dasaea* (Stirton) Tønsberg – Dekalb: *Beeching 3242.*
+*Placynthium flabellosum* (Tuck.) Zahlbr. – Dekalb: *Beeching 3156* – [probably southern most record.]
Polymeridium catapastum (Nyl.) R.C. Harris – Baldwin: *Buck 51564.*
Polymeridium quinqueseptatum (Nyl.) R.C. Harris – Baldwin: *Harris 53339*; Escambia: *Buck 51678.*
Polysporina simplex (Davies) Vězda – Escambia: *Buck 51693.*
Porina heterospora (Fink) R.C. Harris – Baldwin: *Hansen 2921, Harris 53299*; Escambia: *Beeching 2709.*
+*Porina scabrida* R.C. Harris – Baldwin: *Buck 51626, Harris 53318.*
Porpidia macrocarpa (DC.) Hertel & A.J. Schwab – Dekalb: *Beeching 3157.*
Pseudoparmelia cubensis (Nyl.) Elix & T.H. Nash – Baldwin: *Beeching 2640, Lendemer 9069.*
Pseudoparmelia uleana (Müll. Arg.) Elix & T.H. Nash – Baldwin: *Hansen 2883.*
+*Pseudosagedia cestrensis* (Michener) R.C. Harris – Baldwin: *Buck 51595,*
Pseudosagedia rhaphidosperma (Müll. Arg.) R.C. Harris – Baldwin: *Buck 51631*; Escambia: *Beeching 2717, Buck 51678.*
Punctelia rudecta (Ach.) Krog – Baldwin: *Beeching 2602, Hansen 2904, Harris 53269*; Escambia: *Beeching 2707.*
Pyrenula concatervans (Nyl.) R.C. Harris – Escambia: *Beeching 2680.*
Pyrenula cruenta (Mont.) Vainio – Baldwin: *Beeching 2629, Buck 51613, Hansen 2892, Harris 53293, Lendemer 9057*; Escambia: *Lendemer 9239.*
Pyrenula leucostoma Ach. – Baldwin: *Buck 51610, Hansen 2923*, *Harris 53298.*
Pyrenula microcarpa Müll. Arg. – Baldwin: *Hansen 2932, Harris 53234*; Escambia: *Lendemer 9150.*
Pyrenula pseudobufonia (Rehm) R.C. Harris – Baldwin: *Beeching 2620*; Escambia: *Harris 53398, Lendemer 9366.*
Pyrenula punctella (Nyl.) Trevisan – Baldwin: *Harris 53316.*
Pyrenula ravenelii (Tuck.) R.C. Harris – Baldwin: *Harris 53296.*
Pyrenula thelomorpha Tuck. – Baldwin: *Hansen 2926.*
Pyrrhospora russula (Ach.) Hafellner – Baldwin: *Harris 53321*; Escambia: *Buck 51656*, *Hansen 2944, Harris 53406*, *Lendemer 9245.*

Pyrrhospora varians (Ach.) R.C. Harris – Baldwin: *Buck 51594, Hansen 2912*; Escambia: *Beeching 2727, Buck 51710, Hodges 1468, Lendemer 9233.*
Pyxine albovirens (G. Meyer) Aptroot – Baldwin: *Harris 53260.*
Pyxine caesiopruinosa (Tuck.) Imshaug – Baldwin: *Harris 53334, Lendemer 9037*; Escambia: *Beeching 2675, Harris 53374, Hodges 1445.*
Pyxine eschweileri (Tuck.) Vainio – Baldwin: *Hodges 1414.*
Pyxine subcinerea Stirton – Baldwin: *Harris 53276.*
Ramalina americana Hale – Escambia: *Beeching 2650.*
Ramalina culbersoniorum LaGreca – Escambia: *Buck 51740, Harris 53390.*
Ramalina montagnei De Not. – Baldwin: *Buck 51601, Hansen 2906, 2914.*
Ramalina stenospora Müll. Arg. – Baldwin: *Buck 51584, Hansen 2894*; Escambia: *Hansen 2971, Lendemer 9362.*
Ramalina willeyi R. Howe – Escambia: *Hansen 2973.*
+*Rinodina maculans* Müll. Arg. – Escambia: *Beeching 2729, Buck 51695.*
+**Sphinctrina tubaeformis* A. Massal. – Baldwin: *Hodges 1439* (on *Pertusaria*).
Sticta carolinensis McDonald – Escambia: *Beeching 2712.*
Strigula smaragdula Fr. – Escambia: *Buck 51684.*
Teloschistes exilis (Michx.) Vainio – Escambia: *Buck 51724, Hansen 2976, Lendemer 9382.*
Tephromela atra (Hudson) Hafellner – Escambia: *Beeching 2685, Lendemer 9364.*
Thelidium minutulum Körber – Escambia: *Beeching 2670, Buck 51651, Lendemer 9260.*
+*Thelocarpon superellum* Nyl. – Baldwin: *Buck 51636.*
Thelotrema adjectum Nyl. – Baldwin: *Hansen 2916, Harris 53307.*
+*Thelotrema leprocarpum* (Nyl.) Tuck. – Baldwin: *Harris 53242.*
Thelotrema monospermum R.C. Harris – Baldwin: *Buck 51623.*
Thelotrema subtile Tuck. – Escambia: *Beeching 2683.*
Trapeliopsis flexuosa (Fr.) Coppins & P. James – Baldwin: *Lendemer 9026* (terricolous).
+**Tremella parmeliarum* Diederich – Escambia: *Buck 51713, Lendemer 9375* (on *Parmotrema perforatum*).
Trypethelium tropicum (Ach.) Müll. Arg. – Baldwin: *Hansen 2936*, *Harris 53284, Lendemer 9045*; Escambia: *Hodges 1471, Lendemer 9156.*
+*Trypethelium variolosum* Ach. – Baldwin: *Lendemer 9048.*
Trypethelium virens Tuck. *ex* E. Michener – Baldwin: *Harris 53257-A, Lendemer 9077*; Escambia: *Buck 53365.*
+*Usnea endochrysea* Stirton – Baldwin: *Buck 51589*; Escambia: *Harris 53393* (norstictic acid).
Usnea mutabilis Stirton – Baldwin: *Hansen 2908*, *Harris 53268*; Escambia: *Hansen 2978, Harris 53360.*
Usnea pensylvanica Mot. – Baldwin: *Harris 53265.*
Usnea strigosa (Ach.) A. Eaton – Baldwin: *Hansen 2893*; Escambia: *Beeching 2722, Lendemer 9227* (psoromic), *9228* (norstictic).
+*Xanthoparmelia pseudocongensis* Hale – Dekalb: *Beeching 3155*.

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Acarospora stictica, a new yellow species containing stictic acid, from Mexico

Kerry Knudsen[1] & John A. Elix[2]

ABSTRACT. – *Acarospora stictica*, a yellow species of *Acarospora* containing stictic acid is described from Mexico.

Introduction

Except for the Sonoran area and Baja California the *Acarospora* of Mexico have been poorly collected and relatively few specimens are available. Species like *Acarospora rouxii* K. Knudsen, Elix & Reeb and *A. rhabarbarina* Hue present in both the United States and South America are not represented in the Mexican collections, but would be expected to occur in Mexico. While examining collections from The New York Botanical Garden, we were happy to find a new taxon, a member of a small group of apparently related yellow species. The most common member of the group is *A. chrysops* (Tuck.) H. Magn. which occurs from the Ozarks to Rocky Mountains, in Arizona south through Mexico, Central America (El Salvador and Costa Rica) and South America (Brazil, Columbia, Venezuela, and the Galapagos Islands) (Magnusson 1929; Knudsen 2007; Knudsen et al. 2008). A second member of the group, *A. affinis* K. Knudsen is known from the Sonoran Desert region of Mexico and Arizona and from New Mexico (Knudsen 2007). These species have a similar morphology comprising a dispersed thallus of thin yellow areoles with distinct rims, areoles which are usually less than 0.5 mm wide and rarely exceed 1.0 mm in width.

Methods

The type specimen was studied using HPLC (Elix et. al. 2003) and normal light microscopy in water and 10% KOH, the amyloid reaction tested with Lugol's solution (I) and with I with pretreatment with 10% KOH, and the ascospores measured in water. Other measurements were made both in water and 10% KOH with dilute I used as stain. 32-36% HCl was used to clear the areoles for the study of the medulla and cortical structure.

The Species

Acarospora stictica K. Knudsen & Elix, **sp. nov.**

Mycobank #511573

FIGURE 1.

Similis *Acarosporae chrysopsis* et *A. affinis*, sed acidum sticticum continente differt.

TYPE: MEXICO: 80 km from Mexico City, 2300 m, on volcanic rock, with *Xanthoparmelia* and *Caloplaca* species, 16.vii.1956, *C.L. Kramer 1987* (NY, holotype).

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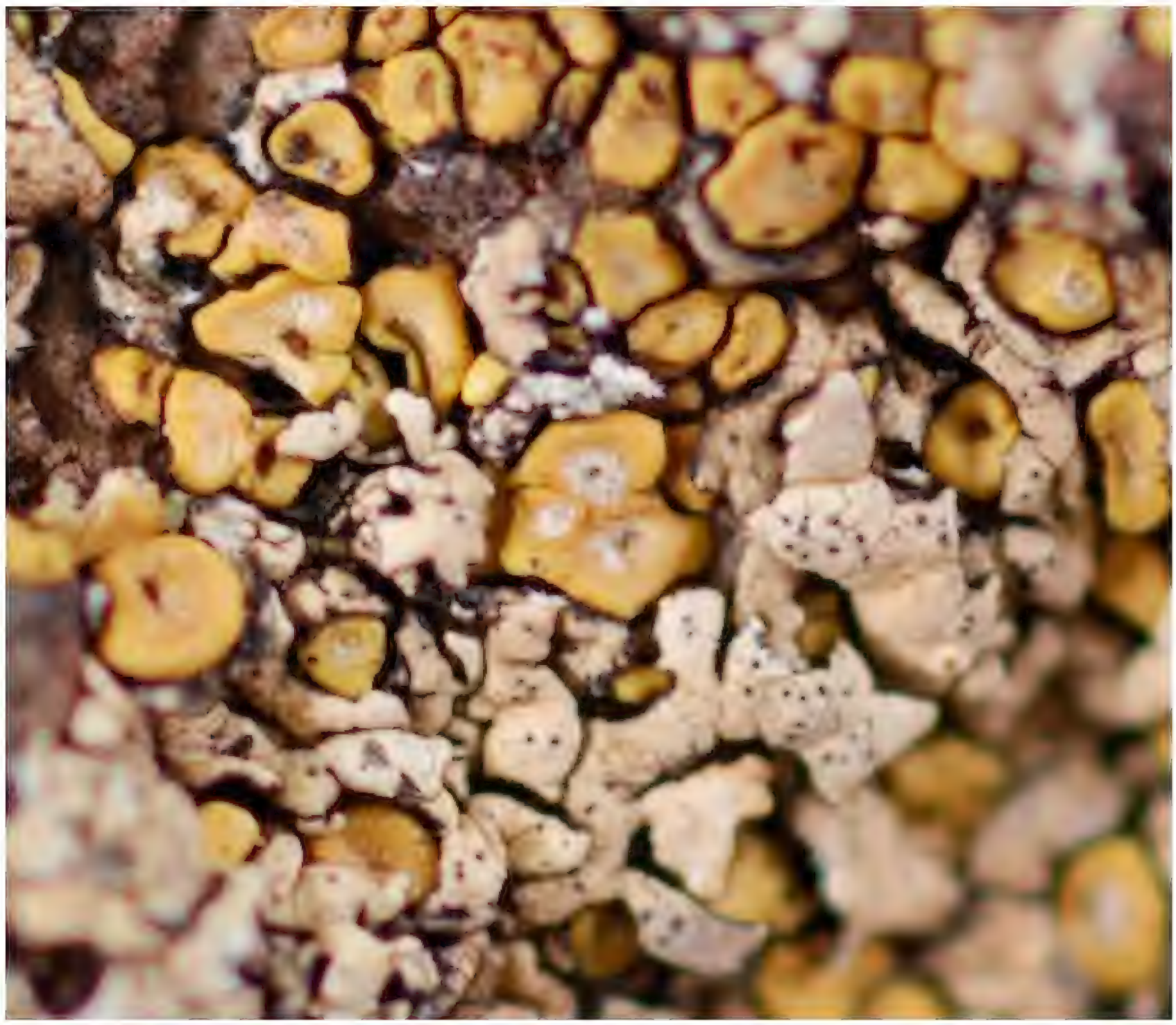

Figure 1. *Holotype of Acarospora stictica.*

Description. – Thallus areolate. Areoles (0.2-)0.3-0.5(-1.0) mm wide, thin (to 0.6 mm thick), round to irregular in shape, usually slightly undulate, rim up-turned or down-turned, concolorus with thallus or black-margined, dispersed or contiguous through vegetative division. Upper surface yellow, somewhat glossy, often with patches of pruina in center. Lower surface yellow in a narrow margin beneath rim, corticate, with prosoplectenchyma parallel to substrate but becoming dark brown or black and carbonized in older specimens, possibly due to interaction with the substrate. Upper cortex 60-90 µm thick, ±obscure; upper syncortex uneven, of hyaline, gelatinized hyphae, 5-10 µm thick or absent; eucortex with obscure hyphae, comprising a paraplectenchymatous yellow upper layer, cells c. 5 µm in diam, 40-70 µm thick, ± a narrow, hyaline lower layer, 10-20 µm thick, the cortex cleared by addition of HCl. Photobiont a chlorococcoid green alga, to 12 µm in diam., algal layer even in cross-section, with no obvious hyphal bands interrupting stratum, 80-100 µm thick. Medulla 200+ µm thick, paraplectenchymatous, cells round to angular, variable in size, from 5-6 µm wide, to 2-4 µm wide and 3-5 µm long, thin-walled, derived from prosoplectenchymatous tissue attached to the rhizohyphae. Rhizohyphae c. 3 µm wide, obscured by crystals but cleared by addition of HCl, broadly attached, not forming a stipe but becoming gomphate by elongation of the medulla. Apothecia 1-3 per areole, round, immersed, punctiform, 0.1-0.3 mm wide; disc yellow, paler than the thallus, sometimes vaguely reddish, lacking a thalline collar or parathecial crown, smooth to very slightly roughed, epruinose. Parathecium to 30 µm thick, of thin, hyaline prosoplectenchyma. Epihymenium 20-25 µm thick, conglutinated in a thick yellow gel. Hymenium 100-140 µm tall, yellow in upper part, hyaline below, coherent, IKI+ deep blue. Paraphyses sparingly branched, 1.0-1.7(-2.0) µm wide

at mid-level, septate, rarely constricted at the septa, cells to 7 µm long, shorter in upper part, apices unexpanded or barely swollen to 2.5 µm wide. Asci 80-100 x 16-20 µm, 100+spores per ascus. Ascospores hyaline, simple, c. 4 x 2 µm. Pycnidia not seen. Spot tests: K+ yellow (best seen on microscope slide), P+ orange. Secondary metabolites (HPLC): epanorin (major), rhizocarpic acid (trace), stictic acid (major), cryptostictic acid (minor), peristictic acid (minor), norstictic acid (trace).

ETYMOLOGY. – The epithet refers to the presence of stictic acid (major) in this species.

DISCUSSION. – Currently *Acarospora stictica* is known only from the type collection but we expect it to be more widespread in the mountains of central Mexico. At present it is the only species of *Acarospora* known to contain stictic acid whereas epanorin and rhizocarpic acid are widespread in the genus. The related species, *A. chrysops,* exhibits two chemotypes, one containing epanorin (major) and ±rhizocarpic acid (trace), the second with rhizocarpic acid (major) and ±epanorin (trace).The other member of this group, *A. affinis*, contains the pigment rhizocarpic acid (major) together with acaranoic acid (major), hypoprotocetraric acid (major) and 4-*O*-demethylnotatic acid (minor). These three species are best distinguished by thin-layer chromatography since yellow species of *Acarospora* sometimes produce a misty yellow coloration on treatment with K (due to rhizocarpic acid or epanorin) which could be mistaken for a positive reaction for stictic acid. However, stictic acid is P+ orange. It is concentrated in the lower layer of the cortex.

Morphologically these three species appear very similar and often have a thick, distinctive white patch of pruina in the center of areole. Thus we consider their secondary chemistry as the prime character for distinguishing these species. *Acarospora affinis* generally has larger areoles than *A. stictica* [0.3- 2 mm vs. (0.2-)0.3-0.5(-1.0)mm] and a prosoplectenchymatous rather than a paraplectenchyamatous medulla, but this character may be variable. *Acarospora chrysops* is even more similar to *A. stictica,* differing only in having a prosoplectenchymatous medulla. However, this character may intergrade between the species because the medulla appears to derive from rhizohyphae. Undoubtedly the morphological and molecular variation between the *A. chrysops, A. affinis,* and *A. stictica* needs further study. Culberson's theory that chemical evolution may occur before morphological differentiation may provide a credible explanation for the chemical diversity of this group (Culberson & Culberson 1970).

Acarospora stictica (Fig. 1) occurs on volcanic rock with a *Xanthoparmelia* containing fumaprotocetaric acid. There was no evidence of parasitic behavior.

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Lichens and Lichenicolous Fungi of the Santa Monica Mountains, Part 3: Additions and Corrections to the Annotated Checklist

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ABSTRACT. – Twenty-three species of lichens and two lichenicolous fungi are added to the annotated checklist of the Santa Monica Mountains maintained for the National Park Service for a revised total of 242 taxa. Seven species have not been collected since 1915: *Aspicilia aurantiaca* Owe-Larss. & A. Nordin, *Aspicilia contorta* (Hoffm.) Kremp., *Aspicilia praecrenata* (Nyl.) Hue, *Bacidia veneta* Ekman, *Carbonea latypizodes* (Nyl.) Knoph & Rambold, *Ionaspis alba* Lutzoni, and *Topelia gyalectodes* (Nyl.) B. D. Ryan & H.T. Lumbsch, for a total of twelve species known only from historic Hasse collections. Based on new taxonomic research, three names are removed from the annotated checklist, *Acarospora smaragdula* var. *lesdainii* (Harm. ex. A. L. Smith) H. Magn, *Miriquidica mexicana* Rambold, Sipman & Hertel, and *Placynthiella knudsenii* Lendemer and replaced by the names *A. hassei* Herre, *M. scotopholis* (Tuck.) B.D. Ryan & Timdal, and *P. hyporhoda* (Th. Fr.) Coppins & P. James respectively. *Lecidea austrocalifornica* Zahlbr. is placed in synonymy with *Carbonea latypizodes,* which is reported new for California.

Introduction

This paper represents the third part in an ongoing floristic study of the Santa Monica Mountains (Knudsen 2005 & 2007a). It represents additions and corrections of the annotated checklist published in 2007 and maintained for the National Park Service. A fourth installment is planned for 2009 to be published in this journal.

The field work for this paper was performed by three of the authors (Knudsen, Lendemer, and Owe-Larsson). Most of work was done in the Sandstone Peak area. The paper is to a great part based on the taxonomic work of Björn Owe-Larsson, Anders Nordin and Leif Tibell (Owe-Larsson et al. 2007). For more information on all *Aspicilia* species discussed one should consult the treatment of the genus in the Sonoran Flora (Owe-Larsson et al. 2007). Ten species of *Aspicilia* are now reported from the Santa Monica Mountains. Eight of the ten *Aspicilia* species reported from the Santa Monica Mountains occur in the Sandstone Peak area above 850 meters on Conejo volcanics.

The methods in this contribution follow those of the previous installments of the series (see Knudsen 2007).

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Acarospora thamnina (Tuck.) Herre, Syn. *Acarospora interposita var. nitidella* H. Magn. (Knudsen 2007b)

This stipe-forming *Acarospora* is common among other crusts in the Sandstone Peak area on Conejo volcanics. This is the nineteenth species of *Acarospora* collected in the Santa Monica Mountains.

U.S.A. California: Ventura Co.: Sandstone Peak 34° 07' 18"N, 118° 55' 26"W, 670 m, on Conejo volcanics, 27.iii.2006, *Knudsen 5662* (UCR).

Aspicilia aurantiaca Owe-Larss. & A. Nordin

This species is known from Baja Sur to Riverside County and San Clemente Island. Its northernmost location is a 1911 Hasse collection from the Santa Monica Mountains. It has not been collected since Hasse in the range but is expected to be re-discovered.

U.S.A. California: Los Angeles Co.: Santa Monica Mountains, 1911, *Hasse 2436* (MIN).

Aspicilia contorta (Hoffm.) Kremp.

This species occurs on carbonate substrates. Hasse collected it twice in the Santa Monica Mountains. There have been no known collections in the range since Hasse's collection from 1903.

U.S.A. California: Los Angeles Co.: Santa Monica Mountains, 1899, *Hasse* (MIN); Santa Monica Mountains, 1903, *Hasse 2420* (MIN).

Aspicilia cuprea Owe-Larss. & A. Nordin

This species is common in California and is common on Sandstone Peak. It is rich in norstictic acid. The large brown areoles are easily recognized except in shade forms, when they become paler.

U.S.A. California: Ventura Co.: Sandstone Peak, 34°07.218'N, 118°55.931'W, 940 m, on exposed Conejo volcanics at the top, 29.x.2004, *Owe-Larsson 9097 & Knudsen*, *Owe-Larsson 9103 & Knudsen*, *Owe-Larsson 9112 & Knudsen*, *Owe-Larsson 9113 & Knudsen* (UPS, all four collections); Sandstone Peak, 34°07.313'N, 118°56.061'W, 880 m, on Conejo volcanics near the top, 29.x. 2004, *Owe-Larsson 9123 & Knudsen* (UPS).

Aspicilia knudsenii Owe-Larss. & A. Nordin

This is species is so far known from five locations in California. It occurs on Sandstone Peak.

U.S.A. California: Ventura Co.: Sandstone Peak, 34°07.266'N, 118°56.049'W, 890 m, on exposed, flat rock (Conejo volcanics) near the top, 29.x. 2004, *Owe-Larsson 9119 & Knudsen* (UPS).

Aspicilia pacifica Owe-Larss. & A. Nordin

This species is common in coastal California and on the Channel Islands. It occurs at scattered locations across the Santa Monica Mountains.

U.S.A. California: Los Angeles Co.: in canyon off Kanan Dune Road, 34°3'38"N 118°48'11"W, 399 m, on large boulder, 11.xi.2003, *Knudsen 623.1 & Sagar* (UCR); **Ventura Co.:** Sandstone Peak, 34°07.218'N, 118°55.931'W, 940 m, exposed rock (Conejo volcanics), northern slope, 29.x.2004, *Owe-Larsson 9106 & Knudsen* (UPS), *Owe-Larsson 9108 & Knudsen* (ASU), *Owe-Larsson 9109 & Knudsen* (UPS).

Aspicilia phaea Owe-Larss. & A. Nordin

This montane species is common in the Sandstone Peak area and throughout California.

U.S.A. California, Ventura Co.: Sandstone Peak, 34°07.218'N, 118°55.931'W, 941 m, on rock at the top (Conejo volcanics), common, 29.x.2004, *Owe-Larsson 9098* (UPS), *Owe-Larsson 9099* (ASU), *Owe-Larsson 9104 & Knudsen* (UPS); Sandstone Peak, 34°07.266'N, 118°56.049'W, 890 m, on flat rock below the top (Conejo volcanics), common, 29.x.2004, *Owe-Larsson 9115:a* (UPS), *Owe-Larsson 9122 & Knudsen* (UPS); 34°07.313'N, 118°56.061'W, 880 m, flat, exposed area below the top, on stone on the ground (Conejo volcanics), 29.x.2004, *Owe-Larsson 9126 & Knudsen* (UPS).

Aspicilia praecrenata (Nyl.) Hue

This rare terricolous species is known in the Santa Monica Mountains only from the type collection on "Barton's Peak" by Hasse. We have not been able to locate the type locality. The only two modern collections are from Santa Rosa Island and San Clemente Island. Recently, at the Santa Rosa Island site, no new specimens could be found for DNA analysis. Several recent collections from the Santa Monica Mountains are similar to *A. praecrenata* and may be conspecific with the type, however further study is needed (Owe-Larsson et al. 2007). These collections are saxicolous, and lack aspicilin.

U.S.A. California: Los Angeles Co.: Santa Monica Mountains, "Barton's Peak", 300 m, on clay and disintegrated granite, ii.1898, *Hasse s.n.* (H-NYL-25559, holotype)

Aspicilia santamonicae Owe-Larss. & A. Nordin

This species is currently known only from the type locality on Sandstone Peak.

U.S.A. California: Ventura Co.: Sandstone Peak, northern slope at the top, 34°07.218'N, 118°55.931'W, 940 m, on rocky outcrop (Conejo volcanics), 29.x.2004, *Owe-Larsson 9107 & Knudsen* (UPS, holotype); Sandstone Peak, northern slope a the top, 34°07.218'N, 118°55.931'W, 940 m, on rocky outcrop (Conejo volcanics), 29.x.2004, *Owe-Larsson 9100a & Knudsen* (ASU); Santa Monica Mountains, Sandstone Peak, near the top, 34°07.266'N, 118°56.049'W, 890 m, on flat, exposed rocky outcrop (Conejo volcanics) 29.x.2004, *Owe-Larsson 9117 & Knudsen* (UPS); Santa Monica Mountains, Sandstone Peak, along the path below the top, 34°07.078'N, 118°55.579'W, 791 m, on shaded, N-facing rock (Conejo volcanics), 29.x.2004, *Owe-Larsson 9128 Knudsen* (UPS).

Aspicilia* aff. *tenuis (H. Magn.) Owe-Larss. & A. Nordin

This is a species currently under taxonomic study to establish if California populations are conspecific with the type population of *A. tenuis* from the Crater Lake in Oregon (Owe-Larsson et al. 2007).

U.S.A. California: Ventura Co.: Sandstone Peak, 34°07.218'N, 118°55.931'W, 940 m, on exposed siliceous boulder (Conejo volcanics) at top of peak, 29.x.2004, *Owe-Larsson 9105 & Knudsen* (UPS).

Bacidia veneta Ekman

This species was collected by Hasse on the mature bark of *Malocothamnus fasciculatus* (Torrey & A. Gray) E. Greene in unspecified canyons in the Santa Monica Mountains. It is the first species segregated from a broader concept of *B. circumspecta* (Ekman 2004). It is a possible victim of shortened fire cycles which reduces old-growth *M. fasciculatus* as well as depleting the spore bank. The species is apparently endemic to the Santa Monica Mountains. It has not been collected since Hasse's death in 1915.

U.S.A. California: Los Angeles Co.: Santa Monica Mountains, Hasse s.n. (FH, four collections)

Candelariella vitellina (Hoffm.) Mull. Arg.

This species is frequent on Conejo volcanics near the summit of Sandstone Peak.

U.S.A. California. Ventura Co.: near summit of Sandstone Peak, 34°7'12"N 118°55'58"W, 921 m, on Conejo volcanics, 23.v.2007, *Knudsen 8474* (UCR).

Dimelaena oreina (Ach.) Norman

This common species is infrequent on Sandstone Peak

U.S.A. California. Ventura Co.: near summit of Sandstone Peak, 34°7'12"N 118°55'58"W, 921 m, on Conejo volcanics, 23.v.2007, *Knudsen 8465* (UCR).

Ionaspis alba Lutzoni

This species is frequent in eastern North America. The Hasse collection is the only collection of this species from the Santa Monica Mountains (Owe-Larsson & Nordin 2007) but the species may still persist in one of the canyons with year-round water.

U.S.A. California: Los Angeles Co.: Santa Monica Mountains, 1913, *Hasse 2573* (MIN).

Lecanora mellea W.A. Weber

This species is common in the Santa Ana Mountains in southern California but has only been collected in the Sandstone Peak area where it is infrequent.

U.S.A. California. Ventura Co.: Tri-Peaks, 34°7'16"N 118°56'0"W, 870 m, on Conejo volcanics, 24.v.2007, *Knudsen 8487* (UCR).

Lecidea atrobrunnea (Lam. & DC) Schaer.

This species is common in the Sandstone Peak area.

U.S.A. California. Ventura Co.: below trail to Tri-Peaks, 34°7'9"N 118°56'42"W, 829 m, on Conejo volcanics, 24.v.2007, *Knudsen 8492* (UCR).

Lepraria borealis Lohtander & Tønsberg

This species is infrequent in southern California, and is likely infrequent in the Santa Monica Mountains. Although it is easily overlooked as are most species of *Lepraria*.

U.S.A. California. Los Angeles Co.: Agoura Hills, 34°08'29"N 118°45'48"W, 253 m, on shaded rock outcrop, 12.i.2008, Lendemer *11464 & Knudsen*, *Lendemer 11474 & Knudsen* (NY, both collections).

Lichenoconium lichenicola (P. Karst.) Petr. & Syd.

This lichenicolous fungus, determined by Jana Kovourková, was recently reported new to North America on *Physcia aipolia* (Humb.) Fürnr. from Santa Rosa Island (Etayo et al. 2007). This is the second report for California and North America. Its host was *Physcia dimidiata* (Arnold) Nyl. on Conejo volcanics

U.S.A. California. Ventura Co.: near summit of Sandstone Peak, 34°7'12"N 118°55'58"W, 921 m, 23.v.2007, *Knudsen 8467a* (PRM)

Lichenostigma subradians Hafellner

This fungus is common throughout California especially on *Acarospora socialis* H. Magn.

U.S.A. California. Ventura Co.: Mishe Mokwa Trail, near split to Tri-Peaks Trail, 34°7'13"N 118°56'39"W, 810 m, on *Acarospora socialis*, 27.v.2007, *Knudsen 8501 & Werth* (UCR).

Staurothele drummondii (Tuck.) Tuck.

Staurothele species are infrequent in the Santa Monica Mountains as the habitats they usually occupy are dominated by *Verrucaria* species instead.

U.S.A: California: Ventura Co.: Sandstone Peak, 34°07'18"N 118°55'26"W, 670 m, on Conejo volcanics in drainage, 11.iii.2005, *Knudsen 2487* (UCR).

Topelia gyalectodes (Nyl.) B.D. Ryan & H.T. Lumbsch

This crustose species on rock is known only from Hasse collections from the type locality in Malibu Canyon (Ryan & Lumbsch 2007)

U.S.A. California: Los Angeles Co.: Santa Monica Mountains, Malibu Canyon, *Hasse s.n.* (H-NYL, holotype; FH, NY, isotypes).

Trapelia placodioides Coppins & P. James

This crustose species on Conjeo volcanics is rare in the Santa Monica Mountains.

U.S.A. California. Ventura Co.: Party Rock, 34°06'37"N, 118°54'22"W, 698 m, on Conejo volcanics, 12.i.2008, *Lendemer 11506 & Knudsen* (NY).

Umbilicaria phaea Tuck.

Common throughout Santa Monica Mountans.

U.S.A. California. Ventura Co.: Sandstone Peak area, near split between Tri-Peaks and Backbone trails, 34°7'9"N 118°56'42"W, 829 m, on Conejo volcanics, 13.v.2007, *Knudsen 8385 & Werth* (UCR)

Verrucaria papillosa Ach.

The species is apparently infrequent in the Santa Monica Mountains, occurring on shale, in dry interior canyons. The names for *Verrucaria* used by Hasse (1913) are generally out-dated or mis-applications of European names.

U.S.A. California: Los Angeles Co.: Calabash Canyon (Santa Monica Mountain Conservancy), north-facing hillside above stream, 34°8'32"N 118°41'21"W, 285 m, on shale, 29.xi.2006, *Knudsen 7956 & Painter* (UCR, SBBG).

Xanthoparmelia amableana (Gyelnik) Hale

The species is common in the Sandstone Peak area.

U.S.A. California. Ventura Co.: near summit of Sandstone Peak, 34°7'12"N 118°55'58"W, 921 m, on Conejo volcanics, 23.v.2007, *Knudsen 8477* (UCR).

Corrections

Acarospora hassei Herre

This species was in the past treated as *Acarospora smaragdula* var. *lesdainii* (Harm. ex. A. L. Smith) H. Magn. Knudsen (2005, 2007a) but further study of the *A. smaragdula* group has led to its recognition as a distinct species and *A. smaragdula* var. *lesdainii* is not recognized as occurring in California (Knudsen 2007b).

Carbonea latypizodes (Nyl.) Knoph & Rambold

Syn. nov. *Lecidea austrocalifornica* Zahlbr., Cat. Lich. Univ., 3: 738. 1925. TYPE: U.S.A, California, Los Angeles Co., Santa Monica Mountains, on soil with *Acarospora obpallens* (Nyl. ex Hasse) Zahlbr. and *Caloplaca subpyraceella* (Nyl. ex Hasse) Zahlbr., xi.1896, *Hasse s.n.* (H-NYL-12067, lectotype).

Mycobilimbia austrocalifornica (Zahlbr.) K. Knudsen, Opuscula Philolichenum, 2: 36. 2005.

Lecidea subplebeia Nyl. ex Hasse, Bull. Torrey Bot. Club, 24: 447. 1897. [non *L. subplebja* Vain. Étud. Lich. Brésil 2: 59 (1890)].

As part of the Sonoran flora project, Christian Printzen recently studied the type of *Lecidea austrocalifornica* and pointed out that it had been misdetermined as a *Mycobilimbia* and had a *Lecanora*-type ascus (Prinzten, pers. comm., Knudsen 2005). The type was re-examined to clarify the issue and the chemistry studied by high performance liquid chromatography (HPLC). The type of *Lecidea austrocalifornica* contained atranorin (minor) and 2'-*O*-methylperlatolic acid. Both of these characters suggested placement in *Carbonea* (Hertel) Hertel and a relationship to *C. latypizodes*. Comparison of specimens of *L. austrocalifornica* with specimens of *C. latypizodes* in NY confirmed that *L. austrocalifornica* is a synonym of that species. *Carbonea latypizodes* is reported new for California, and all of the specimens we have examined represent the chemotype of this species that contains only atranorin and 2'-*O*-methylperlatolic acid (Rambold 1989).

The type locality of of *Lecidea astrocalifornica* was apparently at "Brown's Lake" (probably a vernal pool) on "adobe clay and small pebbles" near the Old Soldier's Home where Hasse worked as a surgeon (Hasse 1913). In Hasse's time this area on the coastal plain would have been considered part the foothills of Santa Monica Mountains. It is now urbanized and part of Santa Monica or Brentwood. The Old Soldier's Home has become a Veterans Hospital and on a recent excursion we were unable to find any lichens on the extensive property which now includes a golf course as well as medical facilities next to the San Diego Freeway. At this time no new specimens have been found of *C. latypizodes* from the Santa Monica Mountains and the report remains historical. It is expected on sandstone. Three other locations have been found in southern California and are cited below.

Carbonea latypizodes can easily be mistaken for a *Lecidella*, particularly *L. carpathica* Körb., because of a similar thallus and dark hypothecium. *Lecidella carpathica* usually contains sufficient atranorin for the thallus to react K+/P+ yellow while *C. latypizodes* in southern California has negative spot tests. Chromatography (TLC or HPLC) is the most reliable method of distinguishing the two species. *Carbonea latypizodes* contains atranorin and 2'-*O*-methylperlatolic acid (Rambold 1989) while *L. carpathica* contains atranorin, chloroatranorin, diploicin, thuringione, 4,5-dichloro-3-*O*-methylnorlichexanthone and ±arthothelin. Some specimens Hasse identified as *Lecidea subplebeia* were found to be *Lecidella asema* (Nyl.) Knoph & Hertel but that species can readily be distinguished from *C. latypizodes* by the presence of xanthones in the thallus which react UV+ orange and C+/KC+ yellow-red (test best performed under the microscope on a squash mount of the thallus).

It should be noted that on the soil with the type specimen of *Lecidea autrocalifornica* there are only a few apothecia of *Caloplaca subpyraceella* and the status of this species needs clarification with a lectotype to be selected from the Hasse specimens present in H, FH or NY. This species is possibly conspecific with *C. crenulatella* (Nyl.) Oliver.

Specimens of *Carbonea latypizodes* : **U.S.A. California. Orange Co.:** Santa Ana Mountains, Weir Canyon, south of Windy Ridge Road, long sandstone slab on north-facing slope, 33°49'52"N 117°43'17"W, 416 m, common on sandstone, 30.v.2006, *Knudsen 6412 & Knudsen* (UCR); Fremont Canyon, south ridge, north-facing slope, 33°49'28"N 117°43'21"W, 618 m, common on soft sandstone, 3.i. 2008, *Knudsen 4445* (NY, PRM, UCR); **Santa Barbara Co.:** Santa Cruz Island, Channel Islands National Park, ridge south of Cananda Cervida along truck trail above Christi Ranch, 34°01'59"N 119°50'23"W, 216 m, on soil and small pebbles in thin-soiled opening of stunted *Adenostoma fasciculatum* chaparral, 16.vi.2007, *Knudsen et. al. 8573* (CANB, UCR).

Miriquidica scotopholis (Tuck.) B.D. Ryan & Timdal

This species is common throughout southern California but in the Santa Monica Mountains only frequent in the Sandstone Peak area. In earlier papers we have reported this species as *M. mexicana* (Knudsen & Owe-Larsson 2005; Knudsen 2007a). Further investigation has led to *M. mexicana* being synonymized with *M. scotopholis* (Lendemer & Knudsen 2008)

Placynthiella hyporhoda (Th. Fr.) Coppins & P. James

This species was previously included in *P. knudsenii* Lendemer (Knudsen 2005 & 2007a) but differs with reddish subhymenium and slightly smaller spores (Printzen & Knudsen 2007). It occurs on sandstone on Castro Ridge and on soil in areas of Conejo volcanics and on detritus at bases of *Adenostoma fasciculatum*. *Placynthiella knudsenii* is no longer recognized as occurring in the Santa Monica Mountains and is currently known from a single collection in the Ozarks and several collections from Riverside and San Diego counties in California.

Conclusions

The annotated checklist, published in 2007, reported 217 taxa of lichens and lichenicolous fungi, with seven known only from historic collections. In this paper 25 more taxa are added to the on-going checklist with seven known only from historic collections, for a total current amount of 242 species and with 14 species known only from historic collections before 1915 (year of Hasse's death). We do not know how many more species will be documented as currently occurring in the range. The final number of species known only from historic collections made by Hasse before 1916 may be as high as 50 or more.

Acknowledgments

We thank Shirley Tucker and Jim Bennett for reviewing this manuscript. We thank Christian Printzen for re-examining the lectotype of *Lecidea austrocalifornica* Zahlhbr. and examining various specimens from the Santa Monica Mountains and determining *Placynthiella hyporhoda*. We thank Richard C. Harris for help in identifying *Carbonea latypizodes*.

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Lepraria friabilis, a New Species from Eastern North America

James C. Lendemer[1], Kerry Knudsen[2] & John A. Elix[3]

ABSTRACT. – *Lepraria friabilis* is described as new to science based on scattered collections from the coastal plain of southeastern North America and disjunct populations from western North America (California).

Introduction

While collecting in the southern United States in recent years the first author has occasionally encountered a *Lepraria* taxon morphologically similar to *Lepraria caesiella* R.C. Harris but differing most markedly in chemistry. While surveying sites with high relative humidity in montane forests in the coastal peninsular ranges of southern California, the second author also discovered two small populations of the same taxon. As part of the continuing taxonomic studies of North American *Lepraria* (Knudsen et al. 2006, 2007; Knudsen & Elix 2007, Lendemer 2005, Lendemer & Harris 2007, Tønsberg 2007) we describe this new species as *L. friabilis*.

Methods

The methods used in this study follow those of Lendemer & Harris (2007). The chemistry of specimens has been studied with thin layer chromatography (TLC) using solvents C and G following the standardized methods of Culberson & Kristisson (1970). Additionally representative specimens of each chemotype have been studied by the third author with HPLC. Specimens have been examined using standard light microscopy and measurements were obtained from hand cut sections of the thallus mounted in water. Illustrations were prepared using a Nikon CoolPix 950 digital camera with the aid Adobe Photoshop CS2.

Several collections were also examined using a Scanning Electron Microscope (SEM). Samples were removed from herbarium specimens with a razor and not subjected to fixation, rinsing, or dehydration. They were mounted on stainless steel stubs using conductive carbon adhesive tabs and sputter coated for 2 minutes at 10 mA, which resulted in a coating of ~20nm of gold. Following coating with gold the samples were examined with a scanning electron microscope (Hitachi S-2700) with a tungsten filament operating with an accelerating voltage of 20kV. Digital images were captured using Quartz PCI Image Management System and Adobe Photoshop 4.0 was used to improve contrast.

As our descriptions of *Lepraria* species (Knudsen et al. 2007, Lendemer & Harris 2007) differ somewhat from those produced by other authors we feel some discussion is warranted here.

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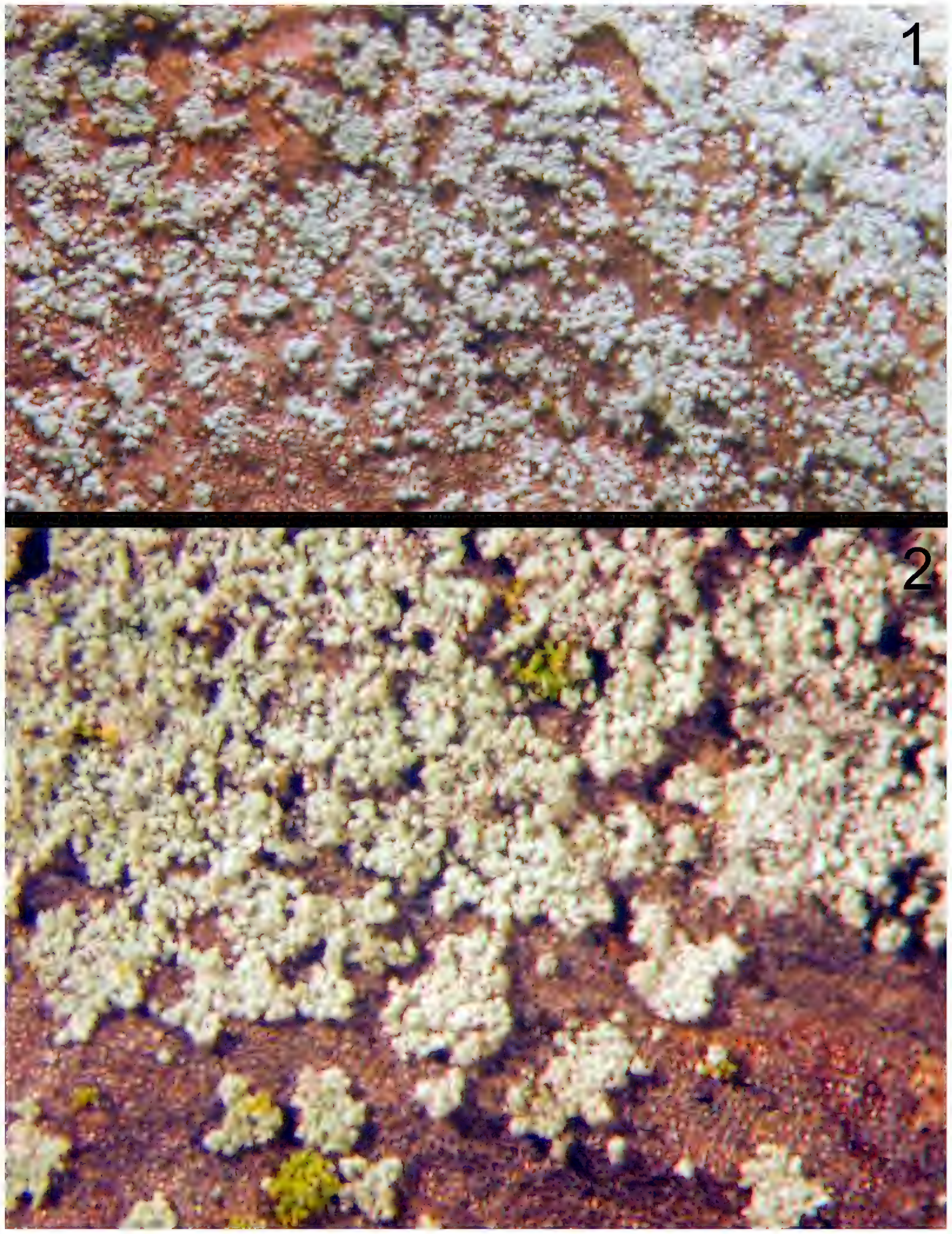


Plate 1. Figures 1-2, thallus of *Lepraria friabilis* (*Lendemer 9063*, NY), magnification 8x and 12x respectively.

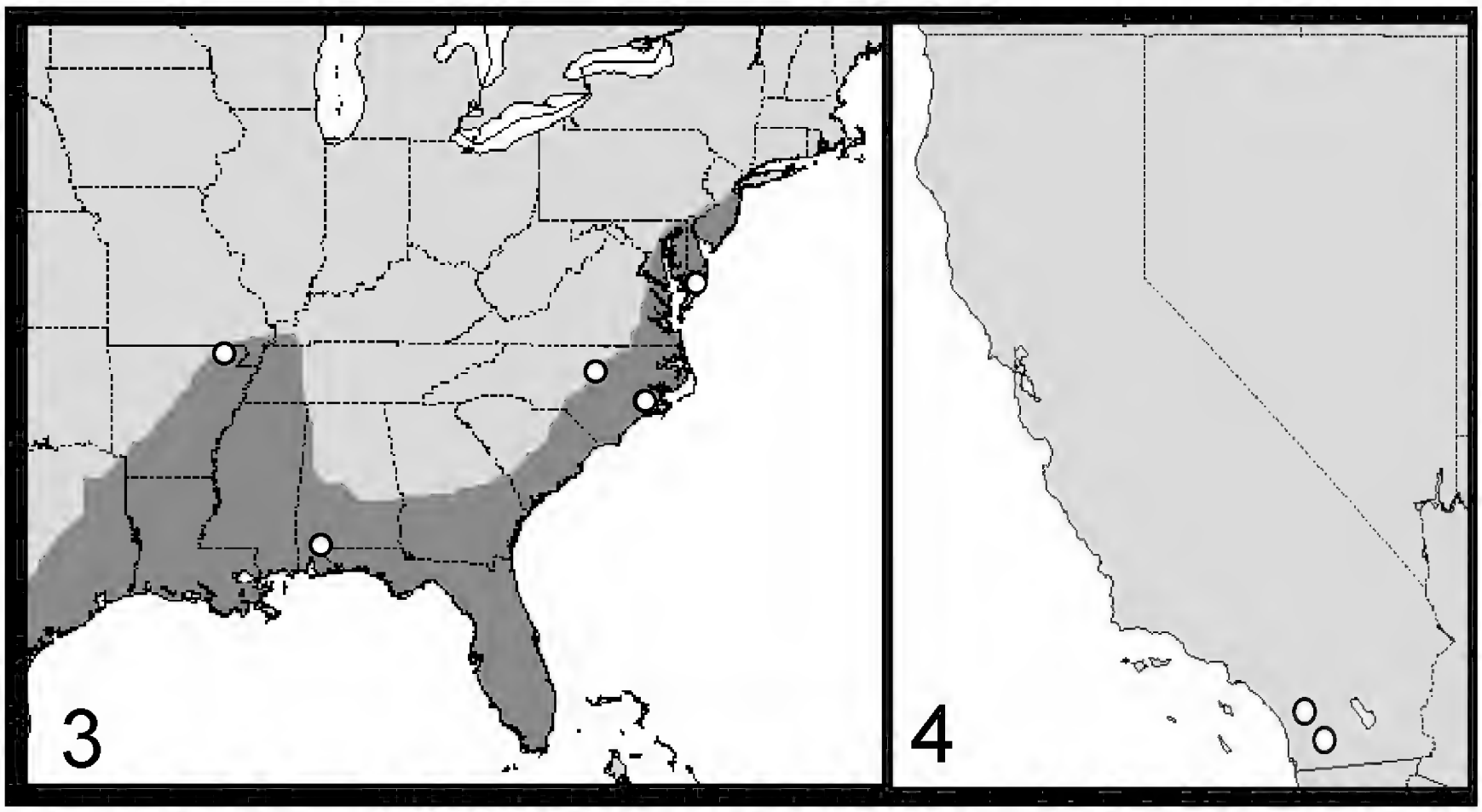


Plate 2. Figure 3, geographic distribution of *Lepraria friabilis* in eastern North America, shaded portion represents rough approximation of the coastal plain. **Figure 4**, geographic distribution of *L. fraibilis* in western North America.

Recently, it has been common practice in the description of *Lepraria* species to refer to individual lichenized thalline units as "soredia" and aggregations of these units as "consoredia" (see Tønsberg 1992). We feel that this terminology is misleading. Kirk et al. (2001)[4] describe a "soredium" in such a manner that it may apply to the thalline units found in the genus *Lepraria*. However, the illustrations (Kirk et al. 2001, fig. 25, j-l) accompanying their description show structures arising from the breakdown of the thallus and contained in structures universally referred to as "soralia". Since the vegetative units in *Lepraria* form the actual thallus rather than arise from a breakdown of distinct stratified layers (e.g. cortex or medulla) it seems best to restrict the term "soredia" to the structures formed in the latter manner. We prefer to refer to the primary lichenized thalline units of *Lepraria*, and other lichen species with leprose thalli, as "granules". In fact, it should be noted that the first major modern study of *Lepraria* (Laundon 1992) referred to the thalline units of *Lepraria* as granules rather than soredia. Similarly, the use of the term "soredia" has not been universal (e.g. Sipman 2004).

As used here, granules are structures that have distinct hyphal walls encasing a lichenized alga. These hyphal walls can be considered ecorticate where the layer consists of gelatinized hyphae or corticate where distinct prosoplectenchyma or paraplectenchyma can be distinguished in one or more layers. But it is probably best to jettison the use of the terms corticate and ecorticate in *Lepraria* because gelatinized layers may be derived from either hyphal form and the forms may represent stages in the development of the granules.

All granules, as well as hyphae, in the leprose thallus of *Lepraria*, through division or fragmentation, can act as propagating units.

The hyphae found in *Lepraria friabilis,* and other *Lepraria* species, present another problem in describing the morphology of *Lepraria* thalli. They are the non-lichenized component of the thallus, and could be referred to as a mycelium. In mature thalli they either form the matrix in which the lichenized granules are situated and/or they originate from the surface of the granules and lace throughout the thallus. They can act as rhizohyphae or anchors attaching the thallus to the substrate and/or binding the thallus together. They may also be adventitious, lichenizing new alga. Fragments probably act as propagules, and

[4] "a non-corticate combination of phyciobiont cells and fungal hyphae having the appearance of a powdery granule, and capable of reproducing a lichen vegetatively"

possibly could be found non-lichenized on a suitable substrate. We have not definitively seen the hyphae in these species anastomosing but it could be expected to occur. These non-lichenized hyphae form a distinct lower layer beneath a necral layer of gelatinized granules in *L. friabilis* and in this paper we refer to this layer as the "hypothallus"

The term "projecting hyphae" has been used for long thick hyphae originating from the granules that are easily seen at lower magnifications. This term is imprecise because all *Lepraria* species we have studied have hyphae attached to the surface of at least some granules, whether easily visible at low magnifications (dissecting microscope) or at higher magnifications (compound microscope, SEM). These hyphae do not differ in size or structure from those discussed in the previous paragraph. Since "projecting hyphae" are present in all species studied, and do not differ significantly in form or function from the rest of the hyphae comprising the thallus, we do not use the term here.

Generally it can be said that the hyphae of a *Lepraria* thallus are of the same type whether adventitious, or forming rhizohyphae or anchors, or a hypothallus, or arising from the granules to bind the thallus together.

Taxonomic Section

***Lepraria friabilis* Lendemer, K. Knudsen & Elix, sp. nov.**

Mycobank #511603.

Ab *Lepraria caesiella* acido fumarprotocetrarico continens et acido atranorico et zeorinicum nullo differt.

TYPE: U.S.A. Alabama. Baldwin Co.: Splinter Hill Bog Preserve, south of CR 47, 0.9 miles west-northwest of Dyas Creek, 1.3 miles west-northwest of I-65, Perdido Quad., elev. 250 ft., *Sarracenia* bog with adjacent hardwood swamp and bottomlands along stream, on *Pinus*, 12.iv.2007, *J.C. Lendemer et al. 9063* (NY, holotype; B, CANB, UCR, UDGA, HB. LENDEMER, isotypes)

Description. – Thallus corticolous, crustose, leprose, without lobes, diffuse, patchy to convergent and continuous, with granules sparsely distributed at first, eventually overlapping and accumulating, very thin (usually less than 0.5 mm thick), greenish to blue-white in color; hypothallus a thin network of hyphae underneath the granules and extending outward from edge of the thallus; granules (10-)20-30 µm in diameter, ecorticate, round, readily dividing, with usually one layer of gelatinized hyaline hyphae surrounding an algal core; hyphae 2-4 µm wide, hyaline, thin walled, obscurely septate, anchoring the granules to each other and to the substrate; photobiont green, coccoid, globose, 7-10 µm in diameter.

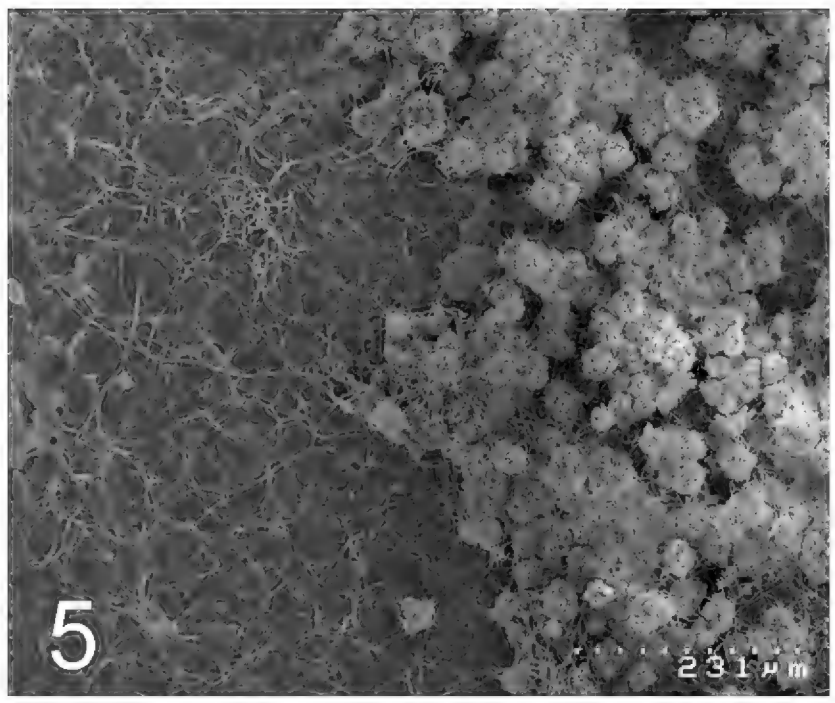
Etymology. – The epithet "friabilis" refers to the fragile, almost friable, appearance of the thallus, especially when it occurs as small dispersed heaps of granules.

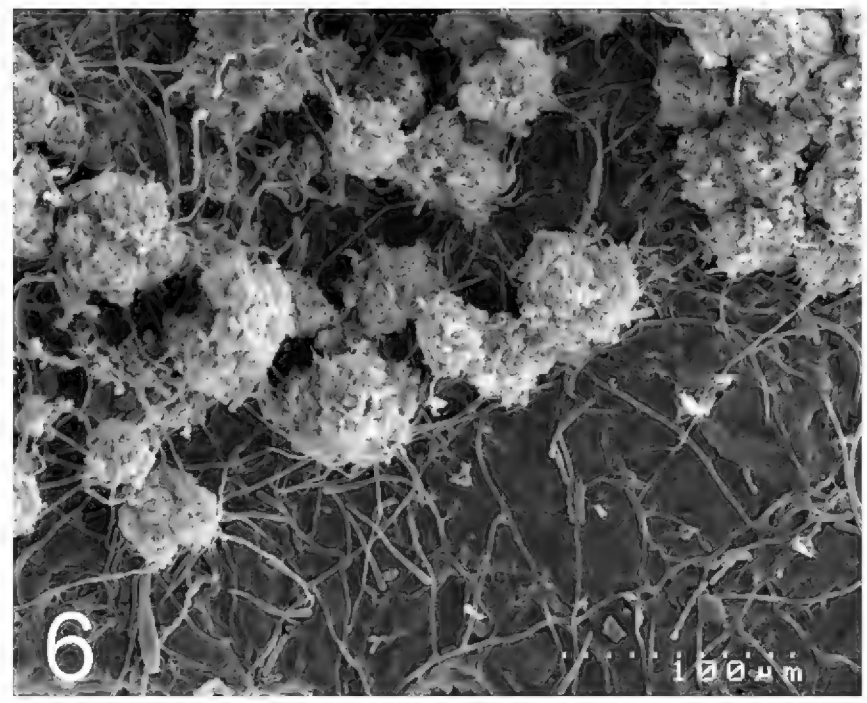
Chemistry. – CHEMOTYPE I: fumarprotocetraric acid (major), protocetraric acid (minor), succinprotocetraric acid (minor), confumarprotocetraric acid (minor); spot tests: K-, C-, KC-, PD+ orange/red. CHEMOTYPE II: fumarprotocetraric acid (only substance detected); spot tests as in chemotype I.

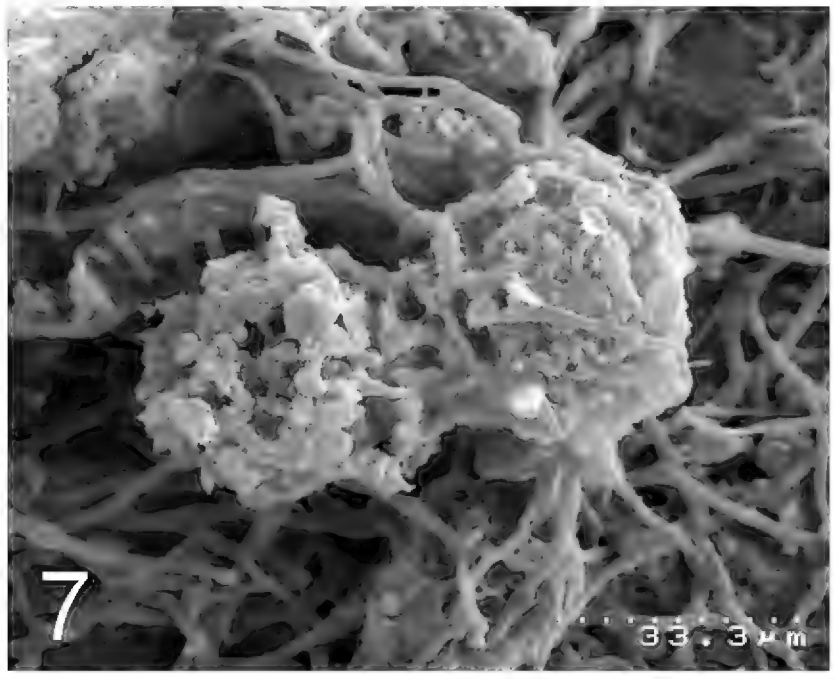
Distribution. – *Lepraria friabilis* is known only from the coastal plain and piedmont of the southeastern USA, with disjunction populations in the peninsular ranges of southern California (Palomar Mountains and Cuyamaca Mountains), USA.

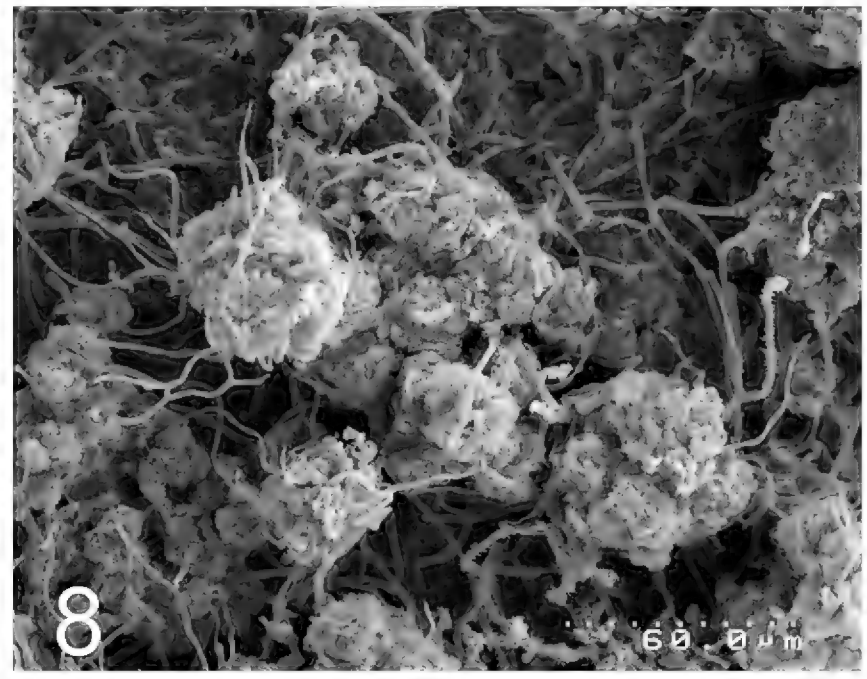
Ecology. – *Lepraria friabilis* is ecologically distinctive in occurring on the bark of conifers (*Pinus, Pseudotsuga, Taxodium*) in humid habitats (swamps, stream valleys, high elevation north slopes). It has not yet been found on the bark of hardwoods or on rocks which occur in similar habitats.

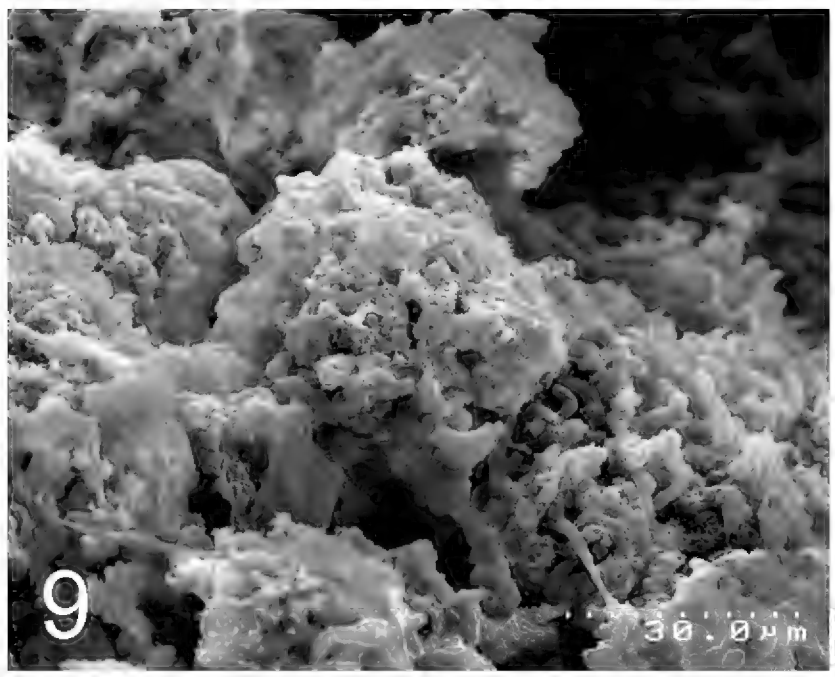
Discussion. – Among North American species of *Lepraria*, *L. friabilis* is most likely to be confused with *L. caesiella* R.C. Harris (which is not known western North America), but the granules in *L. caesiella* tend to be larger (30-50 µm) and readily accrete into larger masses that may be hard to delimit, accumulating to form a thicker contoured thallus. The hyphae comprising the hypothallus of *L. friabilis* appear more abundant and thinner (usually 2-4 µm) than those of *L. caesiella* (usually 4-5 µm) and this species is more common on rough, older bark rather than smooth bark. The two species are readily distinguished by chemistry as *L. friabilis* contains fumarprotocetraric acid rather than atranorin, zeorin.











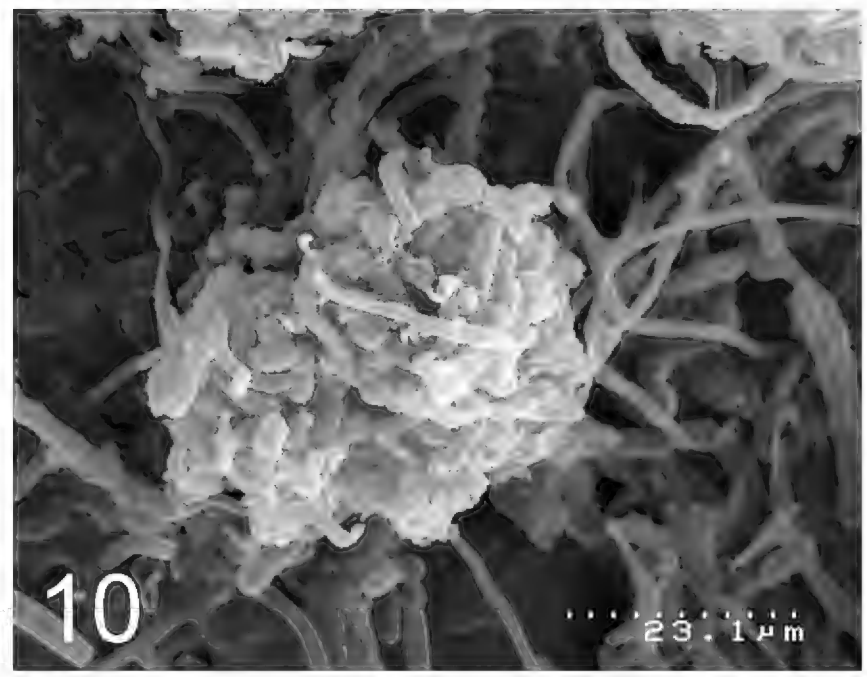


Plate 3. Scanning electron micrographs of thallus and thallus development of *Lepraria friabilis*. **Figure 5**, thallus margin with extensive network of non-lichenized adventitious hyphae extending outward onto the surrounding substrate (*Lendemer 8308*, NY). **Figure 6**, detail of thallus edge and hypothallus (*Lendemer 8308*, NY). **Figure 7**, granules in early stages of development with hyphae anchoring the granules to the substrate and connecting them to the hypothallus (*Lendemer 9603*, NY). **Figure 8**, aggregation of granules, several with abundant attachment hyphae (*Lendemer 8308*, NY). **Figure 9**, fully gelatinized granules in central portion of thallus (*Lendemer 9063*, NY). **Figure 10**, granule in early stage of development with attachement hyphae (*Lendemer 8303*, NY). Scale bars as indicated.

The crystals coating the hyphae of *L. frabilis* are smaller and more concentrated than those of *L. caesiella* and represent fumarprotocetraric acid (dissolving in P, and P+ orange-red) whereas the crystals found in thallus of *L. caesiella* represent atranorin (dissolving in K, and K+ yellow). These crystals should not be confused with the calcium oxalate crystals found in other *Lepraria* species (e.g. *L. normandinoides* Lendemer & R.C. Harris) which are also POL+ but do not dissolve in KOH (Lendemer & Harris 2007).

While *L. friabilis* and *L. caesiella* are ecologically similar in being corticolous, the substrate range of *L. friabilis* appears to be much more restricted (conifers) when compared to *L. caesiella* (bark of conifers and hardwoods as well as acidic rock). In eastern North America *L. friabilis* is also phytogeographically distinct from *L. caesiella* in having a Coastal Plain-Piedmont distribution rather than an Appalachian-Great Lakes distribution (sensu Brodo et al. 2001). It should be noted that the geographic distribution of *L. friabilis* in eastern North America is similar to that of other species belonging to the "southern" element of the Coastal Plain (*cf.* Lendemer 2006, Lendemer & Knapp 2007).

The disjunct populations of *L. friabilis* in southern California in western North America were not as well developed as the eastern populations which have higher relative annual humidity and they only contained fumarprotocetraric acid, but otherwise were morphologically identical. The current geographic distribution of *L. friabilis* likely represents the collecting bias of the first two authors (JCL and KK). Further field work in the southeastern Coastal Plain and Piedmont, as well as southern California, will almost certainly reveal additional populations of this species.

ADDITIONAL SPECIMENS EXAMINED. – ***CHEMOTYPE I:*** U.S.A. ARKANSAS. CLAY CO.: Black River State Wildlife Area, at boat launch along north side of Black River, ca. 3.2 miles southeast of Reyno, 13.viii.1997, *D. Ladd 20905 & B. Heumann* (NY). MARYLAND. WORCESTER CO.: Pocomoke State Forest, along Corber Branch, 19.iv.2006, *J.C. Lendemer et al. 6415* (NY). NORTH CAROLINA. CRAVEN CO.: Croatan National Forest, north of Havelock, west of SR#70, west of Flanners Beach Campground, 13.xii.2004, *J.C. Lendemer 4217 & E. Tripp* (NY, UCR). WAKE CO.: William B. Umstead State Park, vicinity of lower Sycamore Lake, ~1 mi SW of Ebenezer Church, 14.i.2007, *J.C. Lendemer et al. 8398* (NY, UCR). ***CHEMOTYPE II:*** U.S.A. CALIFORNIA. SAN DIEGO CO.: Palomar Mountain, Palomar State Park, steep N-facing slope, 20.iv.2005, *K. Knudsen 2719 & L. Glacy* (CANB, NY, SDNHM, UCR); Cuyamaca Mountains, Cuyamaca State Park, near Stonewall Mine along Minshall Trail, in sight of lake, 12.x.2007, *K. Knudsen 9205* (B, CANB, FH, H, NY, SBBG, PRM, SDNHM, UCR).

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Opuscula Philolichenum, **5**: 67-76. 2008.

Contributions to the Lichen Flora of North Carolina: A Preliminary Checklist of the Lichens and Allied Fungi at William B. Umstead State Park

GARY B. PERLMUTTER[1] & JAMES C. LENDEMER[2]

ABSTRACT. – A preliminary checklist of lichens and allied fungi collected in William B. Umstead State Park in central North Carolina is here presented, documenting 153 taxa in 76 genera from repeated forays in 2006-2007. Forty-six taxa are newly reported for the North Carolina Piedmont, of which 20 are newly reported for the state, including: *Acarospora dispersa*, *Arthonia dryadum*, *Byssoloma subdiscordans*, *Candelariella reflexa*, *Chrysothrix xanthina*, *Fellhanera hybrida, F. minisinkorum*, *Leiorreuma explicans*, *Lepraria friabilis*, *Peltigera didactyla*, *Phlyctis petraea*, *Placynthiella dasea*, *Polysporina simplex*, *Rinodina oxydata*, *Strigula americana*, *Trapelia placodioides*, *Trapeliopsis gelatinosa* and *Usnea endochrysea*. The lichenicolous fungi *Dactylospora pertusariicola* and *Marchandiomyces corallinus* were found on *Pertusaria plittiana* and *Physcia americana*, respectively. The significance of this baseline checklist for assessing environmental health within a fast growing metropolitan area is discussed.

KEYWORDS. – lichens, North Carolina, Piedmont forest, William B. Umstead State Park.

INTRODUCTION

William B. Umstead State Park lies between the cities of Raleigh and Durham in western Wake County, North Carolina, USA. The park is over 5500 acres (2225 ha) of recovering oak-hickory deciduous forest. Cleared for farming since the 1770's, the soil was exhausted by over a century of poor agricultural practices, and the area was purchased by federal and state agencies to be established as parkland in the 1930's. Currently the park is registered as a Significant Natural Heritage Area in North Carolina (Anonymous 2005). While the plant communities of the park have been classified (Schafale & Weakley 1990), the lichen communities and the biological diversity therein have remained largely unstudied.

The lichen flora of Umstead State Park is of particular interest because this large park contains a largely intact Piedmont forest in the Raleigh-Durham-Chapel Hill area (i.e. Triangle) of North Carolina, a region that is currently undergoing rapid metropolitan growth. Since richer lichen floras have been correlated with higher air quality in the southeastern USA (McCune et al. 1997), an understanding of the lichen flora at this park could serve as a baseline to assess the Triangle's environmental health by comparing it to lichen communities and floras in more heavily impacted areas. In addition, such a baseline checklist could serve in future environmental health assessments in the Triangle to track changes wrought by further land use, changes in air quality, and climatic changes from global warming, as well as changes within the park itself as its forests continue to mature since their protection seventy years ago.

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This report presents a preliminary checklist of lichens and allied fungi for Umstead State Park. The objectives of this report are: 1) to contribute to the growing knowledge of the lichen flora of North Carolina and the Piedmont physiographic province within the state, 2) to provide a lichen checklist of a representative Piedmont forest, and 3) to provide a baseline lichen checklist for use in lichen-based environmental health assessments in the Triangle area.

Methods

William B. Umstead State Park lies between the cities of Raleigh and Durham and adjacent to the RDU International airport in western Wake County, North Carolina, USA. The park lies in the Piedmont physiographic province, characterized by rolling hills that reflect an ancient mountainous geology of Proterozoic and Paleozoic (400-600 million yrs bp) crystalline bedrock, much of it granite. The area has a four-season climate with hot, humid summers and mildly cold winters. Thirty-year (1971-2000) mean climatic data from the RDU weather station include summer maximum and winter minimum temperatures 31.7°C for July and –1.3°C for January, respectively. Yearly mean precipitation is 1093 mm, falling 71-109 mm per month; annual snowfall average is 183 mm (NOAA 2004).

Multiple visits were made to the park to inventory its lichen biota in 2006-2007. These visits included educational group forays led by the first author with follow-up collecting visits in 2006. A two-day intensive foray was conducted by both of us in January 2007 to more thoroughly document the lichen biota of the park. Site locations are depicted in Fig. 1; descriptions are as follows:

SB - The forest immediately behind and NNW of the Visitor Center in the vicinity of Sal's Branch Trail (35°53'03"N, 78°45'41"W), elevation 360-460 ft (110-140 m). Habitat is Mesic Mixed Hardwood Forest (Schafale & Weakley 1990), characterized by a canopy of *Acer rubrum*, *Fagus grandifolia*, *Liriodendron tulipifera*, *Pinus taeda*, and *Quercus rubra*. Area visited repeatedly by GBP beginning February 2006 with the park's first instructional walk and followed by collecting visits.

P - Riparian forest at the junction of Potts Branch Trail and Sycamore Trail (35°52'18"N, 78°45'27"W), elevation 330 ft (101 m). Habitat is Mesic Mixed Hardwood Forest. Area visited by GBP as a field trip while leading a one-day lichen workshop for park staff and the public on 11 November 2006.

SL - Rocky ravines near Sycamore Lake, a converted rock quarry (35°51'46"N, 78°44'59"W), elevation 325-450 ft (99-137 m). Habitats include Mesic Mixed Hardwood Forest variants dominated by *Pinus taeda* near the parking lot in the vicinity of an abandoned group camp, mature beech forest near the lakeshore, and a more open forest with exposed rock faces at and below the dam spillway. First surveyed by GBP on 18 February 2006 with follow-up visits in August 2006, and 14 January 2007, the latter with JCL.

CC - Crabtree Creek Natural Area and Inspiration Trail loop (35°50'34"N, 78°45'35"W), elevation 250-400 ft (76-122 m). Habitat includes Mesic Hardwood Forest with Piedmont/Coastal Plain Heath Bluff (Schafale & Weakley 1990) along the creek itself, the latter of which is characterized by a more open canopy and a shrub layer with *Kalmia latifolia* and *Rhododendron* spp. Visited by GBP on 15 April 2006 with follow-up collecting on 9 May 2006.

PB - Piedmont Beech Natural Area (35°50'18"N, 78°44'24"W), elevation 300-350 ft (91-107 m). Habitat includes Mesic Mixed Hardwood Forest with mature *Fagus grandifolia*, as well as trees in the genera *Acer*, *Carya*, *Pinus*, and *Quercus*. Surveyed by both of us on 13 January 2007.

RC - Reedy Creek area (35°49'54"N, 78°44'49"W). Habitat is Mesic Mixed Hardwood Forest, swampy and wet in places with many small dry streams and occasional rock outcrops. Visited on 1 November 2006 by JCL.

Many taxa encountered were digitally imaged, and specimens of all taxa here reported were deposited as vouchers in the University of North Carolina Herbarium (NCU), Academy of Natural Sciences of Philadelphia (PH), and the New York Botanical Garden (NY). Specimens were identified using standard laboratory techniques including microscopic examination of reproductive structures, chemical spot tests and TLC. Keys consulted included Brodo et al. (2001), Harris (1995) and miscellaneous treatments both in the published and "gray" literature.

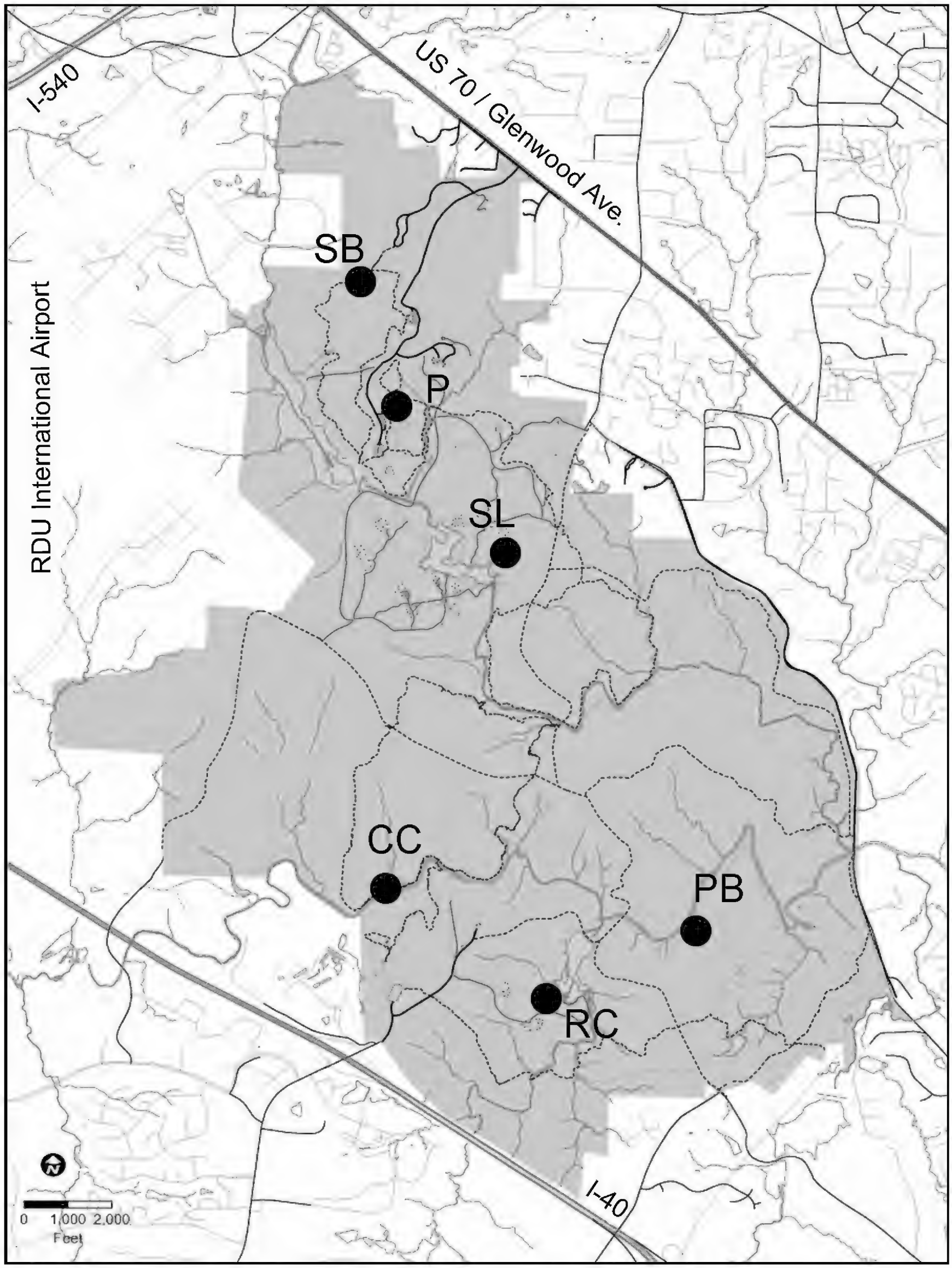

Figure 1. Map of William B. Umstead State Park (shaded). Collecting localities are mapped as large dots and the abbreviations used throughout the list are placed next to the dots.

Lichen observation records and images were entered into North Carolina Division of Park and Recreation's Natural Resource Inventory Database (NRID). The NRID is a web-accessible database (http://207.4.179.38/Checklist/find.php) designed to bring public awareness to the park system's biodiversity. Species checklists of a given organism grouping (e.g. "LICHEN") or that of a community (e.g. "TERRESTRIAL COMMUNITY") can be generated for a particular park or natural area (e.g. "William B. Umstead State Park") from the pull-down menus, and printed for field use. The site also has an image gallery for further reference or "armchair exploration" of a park's natural resources.

Taxa were analyzed by habit, forest layer (i.e. floor, midbole, canopy), and substrate to further describe the lichen biotic composition of the park.

Results And Discussion

A total of 320 collections were made in Umstead State Park, representing 153 species in 76 genera. The flora comprises 59% crustose, 27% foliose and 14% fruticose taxa, the latter including squamulose and dimorphic growth forms. Although this lichen flora is richer in crusts than previously reported from the North Carolina Piedmont as a whole (Perlmutter 2006), the crustose component of the Umstead Park flora is representative of a typical lichen flora (I.M. Brodo, pers. comm.). The report by Perlmutter (2006), which was largely from a survey of herbarium records, appears to reveal a bias toward macrolichens by earlier collectors.

Lichens were found across all forest layers, with 37% taxa found on the floor, 39% on trunk midboles, and 24% in the canopy. On the floor most were found on rock (20% of the taxa) with few species (<5%) each on soil and wood of downed, rotting logs. The canopy is represented by corticolous lichens, found as fallen material (branches, twigs, bark fragments) on the forest floor. Corticolous species, representing both the canopy and midbole levels, make up 76% of specimens collected.

From the US Forest Service's Forest Health Monitoring program an epiphytic macrolichen survey using circular plots produced an Air Quality Gradient for the southeastern USA, with greater species richness in cleaner areas (McCune et al. 1997). As the lichen diversity from plots in central North Carolina (Fig. 6 of that report) appeared to lie in a moderate region of this gradient, similar findings might be expected for plots in Umstead State Park.

While differences in sampling methodology make it impossible to evaluate Umstead State Park on the Air Quality Gradient of McCune et al., the presence of cyanolichens (in the genera *Collema, Leptogium* and *Peltigera*) indicate a relatively healthy forest environment in the park as these taxa are particularly sensitive to air pollution (Richardson and Cameron 2004). Both *Peltigera didactyla* and *P. praetextata* are known to be sensitive to ozone (Peterson et al. 1992, Flenniken 2003). However, the rarity of *Peltigera* (only two specimens were encountered) may indicate a forest environment compromised by the air quality of the surrounding metropolitan area (L. Geiser, pers. comm.).

The purpose of this report is to provide a baseline lichen checklist from a representative Piedmont forest in North Carolina. Although several sites were visited, this inventory should be considered preliminary due to: 1) the limited area of the park explored, 2) the difficulty in collecting saxicolous specimens from smooth rock surfaces, 3) a limited canopy flora available as litterfall, and 4) the often cryptic nature of lichens which makes them easy to be overlooked. Nevertheless this checklist enhances our understanding of the lichen flora at Umstead State Park, and can be used in comparison to other local floras, in particular those that are impacted by human activities such as industrial, urban or agricultural areas. However, further exploration of William B. Umstead State Park and other natural areas of the North Carolina Piedmont is needed to better understand the Piedmont lichen flora of this state.

Annotated Checklist

Checklist of lichens (lichenized Ascomycota), lichenicolous fungi (*), and non-lichenized fungi often treated with lichens (+) collected in William B. Umstead State Park in 2006-2007. Nomenclature follows Esslinger (2008) except where as noted. Locations follow each taxon and are abbreviated as: Sal's Branch Trail (SB), Potts Branch Trail (P), Sycamore Lake (SL), Crabtree Creek Natural Area (CC), and Piedmont Beech Natural Area (PB). Collection number(s) of voucher(s) follow the location symbol. Those with "P" were collected by GBP and deposited in NCU; preceded with "L" collected by JCL and deposited in PH or NY. [1]New to North Carolina; [2]new to the North Carolina Piedmont. New records were determined from comparison with baseline checklists of Perlmutter (2007) and Perlmutter (2006), respectively.

[1]*Acarospora dispersa* H. Magn. – SL: *L-8369*, *P-815*, *P-821.*
[1]*Agonimia* sp. – PS: *L-8320*; SL: *L-8405.*
Thallus terricolous/lignicolous, minutely areolate; ascospores 8/ascus, hyaline, muriform, (30-)33(-37) x (8-)12(-17)µm.
Anisomeridium subprostans (Nyl.) R.C. Harris – PB: *P-753.*
Arthonia cinnabarina (DC.) Wallr. – SL: *P-801.*
[1]*Arthonia dryadum* R.C. Harris & Ladd ined. – PB: *L-8314.*
This comma lichen was first reported from the Ozark highlands of central North America (Harris and Ladd 2005). It is widespread in the southeastern United States and contains gyrophoric acid.
Arthonia quintaria Nyl. – SL: *P-285*; CC: *P-394*; PB: *L-8345.*
Arthonia rubella (Fée) Nyl. – SB: *P-353*; SL: *P-575.*
[2]*Arthopyrenia cinchonae* (Ach.) Müll. Arg. – SL: *L-8403, P-790.*
Arthothelium spectabile (Flot.) A. Massal. – PB: *L-8344.*
Arthothelium taediosum auct. Amer.– SB: *P-263* (PH).
Bacidia heterochroa (Müll. Arg.) Zahlbr. – PB: *L-8316.*
Bacidia schweinitzii (Fr. ex E. Michener) A. Schneid. – SL: *P-579*; PB: *P-773, P-776*, *L-8333.*
[2]*Bacidia suffusa* (Fr.) A. Schneid. – SL: *P-581.*
This corticolous crust has been reported only from the mountainous part of the state (Ekman 1996).
Buellia curtisii (Tuck.) Imshaug – PB: *P-743.*
Buellia cf. mamillana (Tuck.) W.A. Weber – SL: P-817, P-819.
Buellia maculata Bungartz – RC: *L-8061*; SL: *P-290*, *L-8364.*
Buellia stillingiana J. Steiner – CC: *P-389.*
[1]*Byssoloma subdiscordans* (Nyl.) P. James – SL: *P-810*, *L-8411.*
Caloplaca flavovirescens (Wulfen) Dalla Torre & Sarnth. – CC: *316.*
Candelaria concolor (Dicks.) Stein – PB: *L-8310.*
[1]*Candelariella reflexa* (Nyl.) Lettau – CC: *P-391* (sterile).
Canoparmelia caroliniana (Nyl.) Elix & Hale – SB: *P-256*; RC: *L-8069.*
[2]+*Chaenothecopsis* sp. – PB: *L-8349-A.*
[2]*Chrysothrix flavovirens* Tønsberg – SB: *P-352*; SL: *P-786*; RC: *L-8048*; SL: *L-8393.*
[1]*Chrysothrix xanthina* (Vain.) Kalb – PB: *L-8300*, *L-8334*; SL: *L-8360.*
These two yellow leprose crusts differ in soredia morphology, color and substrate (Harris and Ladd 2008).
Cladonia apodocarpa Robbins – SL: *P-272*, *L-8362.*
Cladonia caespiticia (Pers.) Flörke – SL: *P-275*; CC: *P-468*; PB: *P-778*; RC: *L-8074.*
Cladonia cristatella Tuck. – RC: *L-8071*; SB: *L-8415.*
Cladonia didyma (Fée) Vain. var. *vulcanica* (Zoll. & Moritz.) Vainio – SB: *P-647*; RC: *L-8063.*
Cladonia grayi G. Merr *ex* Sandst. – SL: *P-273*, *L-8372*, *L-8410-A.*
Cladonia macilenta Hoffm. – SB: *P-255.*
Cladonia ochrochlora Flörke – SL: *P-789*, *L-8358.*
Cladonia parasitica (Hoffm.) Hoffm. – PB: *P-766*; SB: *P-346*; RC: *L-8067.*
[2]*Cladonia petrophila* R.C. Harris – CC: *P-467.*
Cladonia peziziformis (With.) J.R. Laundon – SB: *P-646*; PB: *P-779*; SL: *L-8370.*
Cladonia ramulosa (With.) J.R. Laundon – SL: *P-274*; PB: *L-8330*, *P-758, P-767*; SB: *L-8416.*
Cladonia robbinsii A. Evans – P: *P-650.*

Cladonia sobolescens Nyl. *ex* Vain. – CC: *P-338.*
Cladonia subtenuis (Abbayes) Mattick – SB: *P-254, P-645*; SL: *L-8410-B.*
[2]*Coenogonium luteum* (Dicks.) Kalb & Lücking *s. lat.* – SL: *P-780*; *L-8414.*
Coenogonium pineti (Ach.) Lücking & Lumbsch – RC: *L-8076*; PB: *L-8298.*
Collema subflaccidum Degel. – RC: *L-8070.*
[1]**Dactylospora pertusariicola* (Tuck. *ex* Willey) Hafellner – SL: *L-8361-A* (on thallus of *Pertusaria plittiana*).
Dibaeis baeomyces (L.) Rambold & Hertel – P: *P-651.*
Dictyocatenulata alba Finley & E. F. Morris – *PB: P-769*, *L-8303*, *L-8315.*
This crust was recently reported for North Carolina in the mountains and Piedmont by Lendemer (2007).
[2]*Dirinaria picta* (Sw.) Clem. & Shear – SL: *P-578.*
Fellhanera hybrida R.C. Harris & Lendemer ined. – CC: *P-465*; SL: *P-808*, *L-8371*, *L-8390*, *L-8410.*
[1]*Fellhanera minisinkorum R.C. Harris & Lendemer ined. – RC: L-8077.*
Flavoparmelia baltimorensis (Gyeln. & Fóriss) Hale – CC: *P-339*; SL: *L-8932.*
Flavoparmelia caperata (L.) Hale – SB: *P-350*; RC: *L-8066.*
Graphis inversa R.C. Harris – SL: *L-8401.*
This specimen has been recently reported as a new state record (Lendemer 2007) for North Carolina.
Graphis lineola Ach. – SL: *P-788*, *L-8350.*
Graphis scripta (L.) Ach. – SB: *P-351*; SL: *P-798.*
Gyalideopsis buckii Lücking, Serus. & Vězda – PB: *L-8335.*
Gyalideopsis ozarkensis Lücking & W.R. Buck– PB: *L-8299.*
Both this and the preceding species were recently described from North America (Lücking et al. 2007).
Heterodermia obscurata (Nyl.) Trevisan – SL: *P-294*, *L-8396*; RC: *L-8065.*
Heterodermia speciosa (Wulfen) Trevisan – SL: *P-785.*
Hypocenomyce sp. – RC: *L-8062.*
Hypotrachyna livida (Taylor) Hale – SB: *P-260*; RC: *L-8055*; SL: *L-8376.*
Hypotrachyna osseoalba (Vain.) Park & Hale – SB: *P-261*; SL: *P-784*, *L-8352.*
[2]*Ionaspis lacustris* (With.) Lutzoni – SL: *P-811*, *L-8391.*
Lecanora hybocarpa (Tuck.) Brodo – CC: *P-393.*
Lecanora strobilina (Sprengel) Kieffer – SB: *P-347*; CC: *P-395.*
[2]*Lecanora subimmergens* Vain. – CC: *P-344*; SL: *P-809*, *L-8400.*
Lecanora subpallens Zahlbr. – CC: *P-387*; P: *P-653.*
[2]*Lecanora thysanophora* R.C. Harris – PB: *P-777*, *L-8332.*
Lecanora sp. – SL: *P-792*, *L-8354.*
The above collections may represent *Lecanora strobilina*, however they are saxicolous and lack decarboxysquamatic acid.
[1]*Leiorreuma explicans* (Fink) Lendemer – SL: *P-574* (NY).
This name is a new combination for *Phaeographina explicans* Fink (Lendemer and Knudson 2008).
[1]*Lepraria friabilis* Lendemer & K. Knudsen – SL: *P-794*, *L-8398.*
This dust lichen is newly described by Lendemer et al. (2008), in eastern North America is known from only the Coastal Plain and Piedmont.
Lepraria lobificans Nyl. – SL: *P-277*; RC: *L-8064*; PB: *L-8295.*
Lepraria sp. (usnic acid, zeroin) – RC: *L-8039, L-8042*; PB: *L-8296.*
This corticolous species is widespread in eastern North America and the Ozarks, and is apparently undescribed. It will be delt with in an upcoming publication on usnic acid containing *Lepraria* species by the second author.
Leptogium corticola Taylor – PB: *L-8341.*
Leptogium cyanescens (Rabenh.) Körber – SL: *P-572*; PB: *P-771*; RC: *L-8057.*
Leptogium dactylinum Tuck. – PB: *L-8321.*
[2]*Lithothelium phaeosporum* (R.C. Harris) Aptroot – PB: *L-8339.*
Loxospora pustulata (Brodo & Culb.) R.C. Harris – SB: *P-345*; PB: *L-8347*; SL: *P-291*, *L-8368.*
This common crust is found both on rock and bark.
[1]**Marchandiomyces corallinus* (Roberge) Diederich & Hawksw. – PB: *L-8311* (on thallus of *Physcia americana*).
Maronea polyphaea H. Magn. – RC: *L-8049.*
[2]*Megalospora porphyritis* (Tuck.) R.C. Harris – PB: *L-8326*, *L-8349*, *P-757.*

[2]*Micarea neostipitata* Coppins & P. May – SL: *L-8402.*
Micarea prasina Fr. s. lat. – PB: *L-8312*, *L-8343*; RC: *L-8073.*
Myelochroa aurulenta (Tuck.) Elix & Hale – PB: *P-747.*
Myelochroa galbina (Ach.) Elix & Hale - PB: *P-774.*
Myelochroa obsessa (Ach.) Elix & Hale – SL: *P-812*, *L-8412.*
[2] *Nadvornikia sorediata* R.C. Harris – CC: *P-342*; PB: *P-768*; RC: *L-8040*, *L-8060.*

This common, yet easily overlooked, corticolous crust is a new report for the North Carolina Piedmont. It has previously been reported from the Coastal Plain (Lendemer & Yahr 2004, Perlmutter 2007).

Ochrolechia africana Vain. – CC: *P-388*; RC: *L-8052.*
[2]*Opegrapha corticola* Coppins & P. James – PB: *L-8329*; SL: *L-8381.*
Opegrapha varia Pers. – PB: *P-761, L. 8304.*
[2]*Opegrapha viridis* Pers. – PB: *L-8309*, *L-8313.*
Parmelinopsis horrescens (Taylor) Elix & Hale – SB: *P-265.*
Parmelinopsis minarum (Vain.) Elix & Hale – SL: *P-295*; PB: *L-8327.*
Parmeliopsis subambigua Gyeln. – SL: *P-783*, *L-8373.*
[2]*Parmotrema gardneri* (C.W. Dodge) Hale – SL: *L-8351.*
Parmotrema hypoleucinum (Steiner) Hale – RC: *L-8058.*
Parmotrema hypotropum (Nyl.) Hale – SB: *P-262*, *P-270*; PB: *P-745*, *P-752*; SL: *P-296*; RC: *L-8044.*
Parmotrema mellissii (C.W. Dodge) Hale – SL: *P-799.*
Parmotrema perforatum (Jacq.) A. Massal. – SB: *P-268.*
Parmotrema reticulatum (Taylor) Hale – SB: *P-258*, *P-264*; SL: *P-288*, *L-8363.*
Parmotrema subisidiosum (Müll. Arg.) Hale & Fletcher – SB: *P-267*; CC: *P-466*; SL: *P-822*, *L-8382.*
Parmotrema submarginale (Michx.) DePriest & B. Hale – SB: *269*; RC: *L 8045.*
[1]*Peltigera didactyla* (With.) J.R. Laundon – SL: *P-818*, *L-8387.*
Peltigera sp. – PB: *P-765*, *L-8302.*

The above material seems similar to *Pelitgera praetextata* (Sommerf.) Zopf, but not conspecific with it. Further study is needed, preferably with molecular methods.

[2] *Pertusaria epixantha* R.C. Harris – SB: *P-257*; SL: *P-796*; RC: *L-8050.*
Pertusaria multipunctoides Dibben – SB: *P-648*; PB: *P-750*, *L-8324*; RC: *L-8041.*
Pertusaria paratuberculifera Dibben – CC: *P-343*; RC: *L-8051.*
Pertusaria plittiana Erichsen – SL: *P-806*, *L-8361*; CC: *P-340.*
Pertusaria pustulata (Ach.) Duby – CC: *P-398.*
Pertusaria subpertusa Brodo – PB: *L-8331*, *P-756.*
Phaeographis inusta (Ach.) Müll. Arg. – SL: *P-577* (PH), *P-787*, *L-8379.*
Phaeographis sp. - SL: *P-576* (NY).

This taxon is widely distributed on hardwoods in the southeastern United States and has been widely confused with *Sarcographa labyrinthica* (Ach.) Müll. Arg. because of the white mealy margins of the lirellae. Using the key in *More Florida Lichens* (Harris 1995) this taxon would indeed key to *S. labyrinthica* if one were unfamiliar with the heavily carbonized compound stroma in that species.

Phaeophyscia ciliata (Hoffm.) Moberg – PB: *L-8346.*
Phaeophyscia rubropulchra (Degel.) Essl. – SL: *P-280*, *P-803*, *L-8388*; PB: *P-764*; RC: *L-8054.*
[2]*Phlyctis ludoviciensis* (Müll. Arg.) Lendemer – SL: *P-797*, *L-8383*; PB: *L-8325, P-744, P-746.*

This common crust has only been reported from the Coastal Plain (Lendemer & Yahr 2004) and is here newly reported for the Piedmont.

[1]*Phlyctis petraea* R.C. Harris ined. – CC: *P-341.*
[2]*Phyllopsora confusa* Swinscow & Krog – RC: *L-8072.*
Phyllopsora corallina (Eschw.) Müll. Arg. – PB: *P-754, L-8307.*
Physcia americana G. Merr. – PB: *P-770*; RC: *L-8056.*
Physcia pumilior R.C. Harris – SB: *P-271*; SL: *P-286*; CC: *P-397*; RC: *L-8043.*
Physcia subtilis Degel. – SL: *P-278*, *L-8377.*
Physciella chloantha (Ach.) Essl. – SL: *P-791*, *L-8409.*
[1]*Placynthiella dasea* (Stirton) Tønsberg – SL: *P-793*, *L-8378*, *L-8404*; RC: *L-8075.*
Placynthiella icmalea (Ach.) Coppins & P. James – RC: *L-8046.*
[1]*Polysporina simplex* (Davies) Vězda – SL: *P-814*, *P-820*, *L-8395.*

Porina heterospora (Fink *ex* J. Hedrick) R.C. Harris – PB: *L-8337.*
Porpidia albocaerulescens (Wulfen) Hertel & Knoph – SL: *P-281*, *P-800*, *L-8386.*
This saxicolous crust is dominant on granite boulders in rocky ravines near Sycamore Lake and along Crabtree Creek and Sycamore Creek near Potts Branch trail; it is likely widespread in the park in similar shady rocky habitats.
Pseudosagedia cestrensis (Tuck. ex E. Michener) R.C. Harris – RC: *L-8047-A*; PB: *L-8322, P-772, P-759.*
[2]*Pseudosagedia guentheri* (Flot.) Hafellner & Kalb – SL: *P-804*, *L-8356.*
Punctelia rudecta (Ach.) Krog – SL: *P-287.*
Punctelia subrudecta auct. Amer. – PB: *L-8308.*
[2]*Pyrenula citriformis* R.C. Harris – PB: *L-8340, P-762*; SL: *L-8359*, *P-795.*
Pyrenula leucostoma Ach. – SL: *P-807*, *L-8406.*
[2]*Pyrenula punctella* (Nyl.) Trevisan – SB: *P-354*; PB: *P-751*; SL: *L-8355.*
This pox lichen is common on large beech trunks.
Pyrrhospora varians (Ach.) R.C. Harris – SB: *P-978.*
Pyxine sorediata (Ach.) Mont. – RC: *L-8053.*
[2]*Ramalina americana* Hale – PB: *P-763.*
Rhizocarpon reductum Th. Fr. (Syn. *R. obscuratum*) – SL: *L-8394*, *P-820a.*
Rinodina granuligera H. Magn. – PB: *L-8319.*
[2]*Rinodina maculans* Müll. Arg. – CC: *P-390*; PB: *L-8336.*
[1]*Rinodina oxydata* (A. Massal.) A. Massal. *s. lat.* – SL: *P-289.*
The specimen was collected on a vertical rock wall below the Lake Sycamore Dam.
Rinodina tephraspis (Tuck.) Herre – SL: *P-817*, *L-8380*, *L-8400.*
[1]*Strigula americana* R.C. Harris – PB: *L-3883*, *L-8342.*
[2]*Thelotrema subtile* Tuck. – SB: *P-349*; SL: *P-573* (PH); PB: *P-775*; RC: *L-8047*; PB: *L-8297.*
Like *Nadvornikia sorediata* above, this too is a new report for the North Carolina Piedmont, only reported previously from the Coastal Plain (Lendemer & Yahr 2004, Perlmutter 2007).
Trapelia glebulosa (Sm.) J.R. Laundon – PB: *P-760.*
[1]*Trapelia placodioides* Coppins & P. James – SL: *P-805*, *L-8389.*
[1]*Trapeliopsis gelatinosa* (Flörke) Coppins & P. James – SL: *L-8385.*
Trypethelium virens Tuck. *ex* Michener – SL: *P-570.*
Observed on trunks of holly (*Ilex* spp.) almost exclusively in each site; it is likely common throughout the park on this substrate.
Tuckermannella fendleri (Nyl.) Essl. – SB: *P-259*; SL: *L-8375.*
[1] *Usnea endochrysea* Stirton – PB: *L-8318*; SL: *L-8365*, *L-8367.*
Usnea mutabilis Sirton – SL: P-282.U
Usnea strigosa group (sterile) – SB: *P-644*; CC: *P-392*; RC: *L-8059* (norstictic acid); SL: *L-8366* (psoromic acid).
Verrucaria sp. – SL: *P-293*; *L-8407.*
Thallus saxicolous on siliceous rock, endolithic; perithecia 0.3-0.4mm diameter, <1/3 immersed in substrate, exciple lacking below; ascospores 8/ascus, 22-25.5 x 8-10µm.
Xanthoparmelia conspersa (Ehrh. *ex* Ach.) Hale – SL: *P-279*, *L-8328.*
This saxicolous foliose lichen is found abundantly on exposed rock surfaces in the Lake Sycamore Dam spillway.
Xanthoparmelia plittii (Gyeln.) Hale – SL: *P-813*, *P-816*, *L-8384*, *L-8397.*

Acknowledgments

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Pertusaria appalachensis, a new species from Eastern North America

James C. Lendemer[1], Richard C. Harris[2] & John A. Elix[3]

ABSTRACT. – *Pertusaria appalachensis* is described as new to science based on material from the southern Appalachian Mountains of eastern North America. *Pertusaria appalachensis* is the first North American species known to produce xanthones in the medulla of the thallus.

Introduction

The southern Appalachian Mountains of eastern North America have long been recognized as hosting a remarkable assemblage of lichens, including numerous disjunct and endemic species (Lendemer & Tripp 2008). Despite nearly continuous study for well over a century the region remains poorly explored, especially for crustose lichens and lichenicolous fungi. Recent field work by the senior author and his colleagues has resulted in the recognition of numerous new and interesting taxa (Harris & Ladd 2008; Lendemer 2007, 2007a; Lendemer & Harris 2007; Lendemer et al. 2007; Lücking et al. 2007; Lendemer & Sheard 2006; Sheard et al. 2008; Tønsberg 2007). In recent years we have collected a species of *Pertusaria* with xanthones restricted to the medulla, from middle to high elevations in the southern Appalachians. As medullary xanthones are rare elsewhere in the genus *Pertusaria* and previously unknown in any North American species, it seemed likely that the species represented another undescribed taxon endemic to the Southern Appalachians. An examination of species with a similar chemistry (i.e., containing arthothelin and related substances) revealed that in fact, arthothelin was present in the medulla rather than the cortex of those species as well. Comparison of these taxa confirmed the distinctness of the material from the southern Appalachians, and consequently we describe it here under the name *Pertusaria appalachensis*.

The New Species

Pertusaria appalachensis Lendemer, R.C. Harris, and Elix **sp. nov.**

Mycobank #511604.

TYPE: U.S.A., South Carolina., Pickens Co., Dry, logged woods along Lookout Trail to Eastatoe Creek National Heritage Preserve, elev. ca. 534 m., on *Acer rubrum*, 27.ix.1989, *R.C. Harris 24795* (NY, holotype; CANB, isotype).

Thallus corticola, griseus vel cinereus, hebetatus, tenuis ad crassiusculus, continuus et verruculosus; isidiis et sorediis desitutus. *Verrucae* fertiles thallo concolorae, conspicuae, dispersae et 0.8-2.0mm diam.; ostiola conspicua, alba, lutea annulata, in verrucae 1-2(-4)nae. Ascosporae 8nae, uniseriatae vel biseriatae, ellipsodeae, laeves vel exasperatae, (56.3)-68.5-(80.68)µm longae, (27.9)-33.54-(39.18)µm latae. *Medulla* arthothelin continens. *Cortex* substantiam nullam continens.

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Plate 1 ***Pertusaria appalachiensis.*** **Figure 1.** Detail of fertile wart with pale brown ostiole surrounded by yellow ring of xanthone rich medullary tissue visible due to thinning of the cortex (scale bar = 1mm). **Figure 2.** Thallus with fertile warts (scale bar = 1mm). Both figures taken from holotype (NY).

DESCRIPTION. – **Thallus** corticolous, ash-gray to yellow-gray, dull, thin to thick, continuous and becoming verruculose; **diaspores** absent; **apothecia** verruciform (pertusariate following Dibben (1980), concolorous with thallus, scattered and often becoming confluent with an irregular outline, 0.8-2.0mm diam., 0.5-0.8mm tall; **ostioles** conspicuous, pale-brown to somewhat darkened, with a conspicuous yellow ring where the medulla is visible through the thin cortex, 1-2-(3-4) per verruca; **ascospores** 8/ascus, uniseriate to weakly biseriate, smooth to moderately roughened, (56.3)-68.5-(80.68) x (27.9)-33.54-(39.18)µm.

CHEMISTRY. – Cortex: no substances present. Medulla: arthothelin [major], 6-*O*-methylarthothelin [minor], 2,4-dichloronorlichexanthone [minor], 2,5-dichloronorlichexanthone [minor], 4,5-dichloronorlichexanthone [minor]. Spot tests; cortex: K-, C-, KC-, P-, UV-; medulla: K+ yellow, KC+ orange, P-, UV+ bright orange.

ECOLOGY AND DISTRIBUTION. - The species is known only to occur on the bark of hardwoods (*Acer, Betula Fagus, Quercus*) at middle to high elevations (~1700-4000 ft.) in the southern Appalachian Mountains of eastern North America where several other apparently endemic lichens have been described recently (Lendemer 2007, Lendemer et al. 2007, Tønsberg 2007).

DISCUSSION. - Cortical xanthones are common in the genus *Pertusaria* (Dibben 1980), and the diverse array of secondary compounds found in the medulla of *Pertusaria* species has been widely used as a key taxonomic character for distinguishing taxa in the genus (Archer 2004; Elix & Archer 2007; Messuti et al. 2006, 2007). While Dibben (1980) did not describe any taxa with medullary xanthones, investigation of the other species containing arthothelin revealed that it is similarly restricted to the medulla rather than the cortex in those species. Thus, *P. appalachensis* is not the only species of *Pertusaria* that produces xanthones in the medulla, but rather is one of a group of taxa that share this chemistry and character. In view of the difficulties encountered in ascertaining the localization of arthothelin in the present work, we suggest that future studies of *Pertusaria* should examine the location of xanthones (and other secondary compounds) and that this data should be included in revisions and descriptions as it may be taxonomically informative.

Among the known species of *Pertusaria* which produce arthothelin *P. appalachensis* is distinguished by its corticolous habit, conspicuous raised verruciform ascomata, the thallus lacking diaspores, the small hyaline ascospores (56-80 x 27-39µm; KOH-), and 8-spored asci. A key to the species of *Pertusaria* with 8-spored asci which occur in the southern Appalachians is included below (following the literature cited), as well as a key to the species of *Pertusaria* which produce arthothelin.

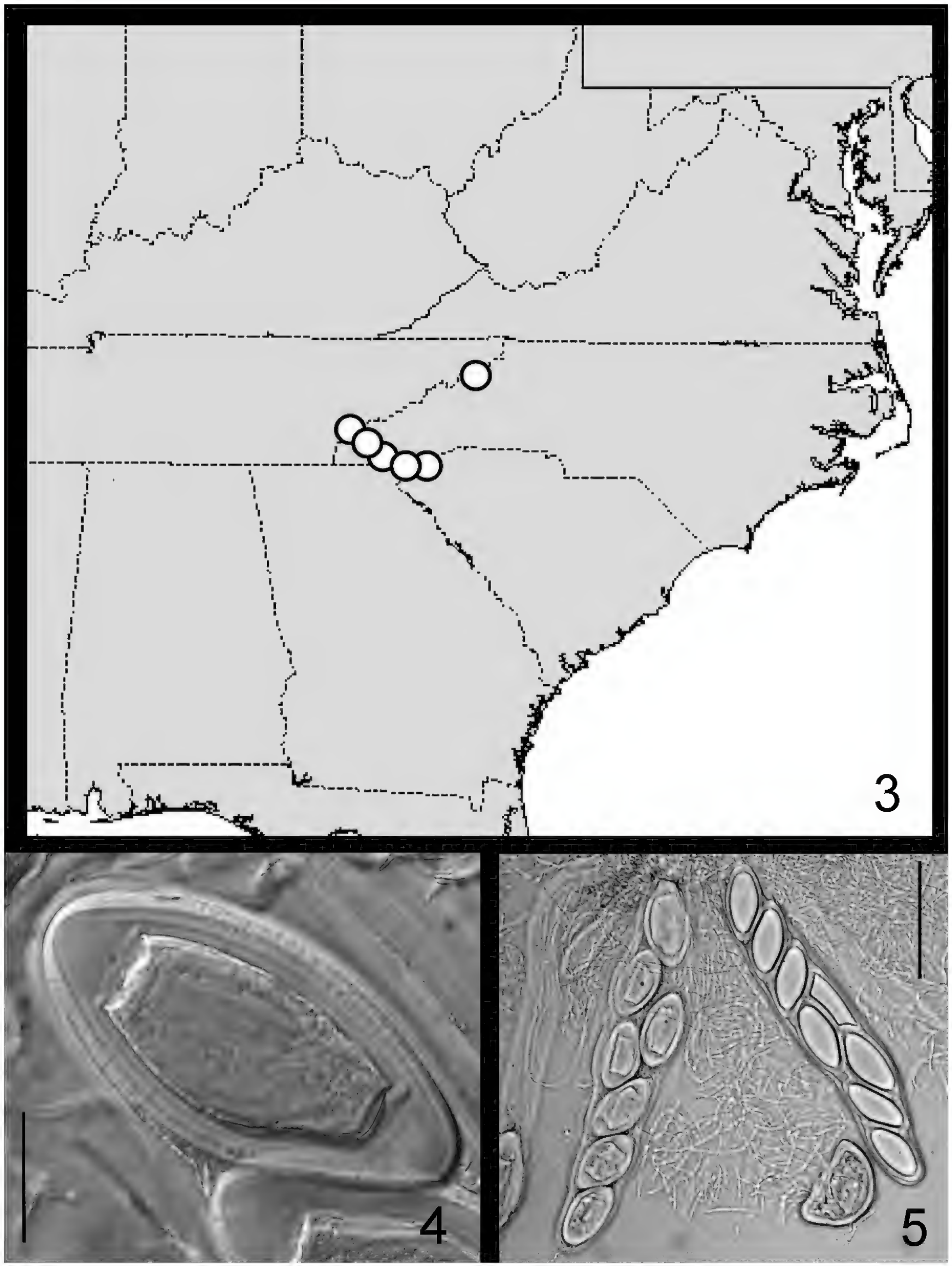

Plate 2 ***Pertusaria appalachensis*****. Figure 3.** Range map. **Figure 4.** Ascospore (scale bar = 20µm). **Figure 5.** Asci (scale bar = 100µm). Both figures 4 and 5 taken from holotype.

Specimens Examined. – U.S.A. Georgia. Rabun Co.: Chattahoochee National Forest, Rabun Bald, 4.x.1997, *R.C. Harris 41276* (NY), *R.C. Harris 41281-A* (NY), *R.C. Harris 38928* (NY). North Carolina. Graham Co.: Nantahala National Forest, Cherohala Skyway [NC 143], Mudd Gap, 1.x.1997, *R.C. Harris 41048* (NY); Nantahala National Forest, Cherohala Skyway [NC 143], Stratton Ridge, 1.x.1997, *R.C. Harris 41001* (NY). Macon Co.: Nantahala National Forest, vicinity of Park Creek Trailhead, 2.x.1997, *R.C. Harris 41165* (NY). South Carolina. Pickens Co.: logged woods along Lookout Trail to Eastatoe Creek National Heritage Preserve, 27.ix.1989, *R.C. Harris 24795* (NY). Tennessee. Carter Co.: trail down from Carvers Gap, 6.x.1985, *R.C. Harris 18346* (NY).

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We thank Alan Archer for his helpful discussion of *Pertusaria* species that produce arthothelin, for providing us with a list of those taxa. We also thank Alan Archer and Doug Ladd for reviewing the manuscript.

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Appendix I.

Key to Species of *Pertusaria* in the Southern Appalachians with 8-spored asci

1. Cortex UV+ bright orange or yellow.....2

    2. Cortex UV+bright yellow (lichexanthone).....*P. paratuberculifera*
    2. Cortex UV+bright orange.....3

        3. Ostiole without yellow ring or cap; medulla K+ red (norstictic acid present).....*P. rubefacta*
        3. Ostiole with yellow ring or cap; medulla K- or K+ yellow (norstictic acid absent).....4

            4. Ostiole raised, with a yellow nipple-like cap.....*P. texana*
            4. Ostiole depressed, with yellow ring.....*P. epixantha*

1. **Cortex** UV- or UV+ weak pink/orange; **medulla** UV+ or UV-.....5

    5. **Medulla** C and KC+ orange, UV+ bright orange.....*P. appalachensis*
    5. **Medulla** C-, KC various, UV-.....6

        6. Medulla K+ red (norstictic acid present); warts large; ascospores +/-uniseriate.....*P. propinqua*
        6. Medulla K- (norstictic acid absent); warts small; ascospores biseriate.....*P. ostiolata*

Appendix II.

Key to Species of *Pertusaria* Producing Arthothelin

1. Saxicolous; ascospores 8/ascus.....*P. melanospora*
1. Corticolous; ascospores various.....2

    2. Thallus isidiate, apothecia rare; arthothelin minor accessory with thiophanic acid; Papua New Guinea.....*P. karkarensis*
    2. Thallus without isidia; apothecia common; arthothelin concentration and geographic distribution various.....3

        3. Ascospores 2-4/ascus.....4

            4. Ascospores 2/ascus; arthothelin minor accessory with thiophanic acid.....*P. saltuensis*
            4. Ascospores 4/ascus; arthothelin minor accessory with 6-*O*-methylarthothelin.....*P. inconspicua*

        3. Ascospores (6)-8/ascus.....5

            5. Ascospores ≤80µm long.....6

                6. Apothecia immersed in thallus; arthothelin a major substance with thiophanic acid; New Zealand.....*P. bartlettii*
                6. Apothecia raised, conspicuous; thiophanic acid absent.....7

                    7. 6-*O*-Methylarthothelin major with arthothelin major or minor; ascospores 70-80µm long.....*P. oblongata*
                    7. Arthothelin major with 6-*O*-methylarthothelin minor; ascospores 60-70-(80)µm long.....*P. appalachensis*

            5. Ascospores >(70)-80µm.....8

                8. Ascospores 70-120µm long; South America.....*P. papillulata*
                8. Ascospores 112-120µm long; India.....*P. idukkiensis*

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Ramonia vermispora, a new species from the Sonoran Desert Region of Southwestern North America

James C. Lendemer[1] & Kerry Knudsen[2]

ABSTRACT. – *Ramonia vermispora*, a new saxicolous species from southern California, U.S.A. is described as new to science. The new species is presumed to be endemic to montane regions of southern California, and related to *R. ablephora* and *R. gyalectiformis* both of which are also endemic to the region.

Introduction

Ramonia Stizenb. is a small genus of just over thirty species of minute, mostly corticolous, crustose lichens (Vězda 1966, 1967, 1973). Although the type of the genus *R. valenzueliana* (Mont.) Stizenb. is primarily tropical in distribution, the majority of species have been described from Europe (Canals & Gómez-Bolea 1992; Coppins 1987; Coppins et al. 1994; Vězda 1966, 1967, 1974). The small size of most species and their occurrence on substrates not usually inhabited by other lichens likely accounts for the scarcity of reports and collections of the genus.

Seven species of *Ramonia* are known to occur in North America (Esslinger 2008), two of which have also been reported from southern California (viz. *R. ablephora* (Nyl. *ex* Hasse) R.C. Harris and *R. gyalectiformis* (Zahlbr.) Vězda). The species reported form southern California are anomalous in the genus because of their saxicolous habit. The lack of available material of these taxa led Harris (1993) to consider *R. ablephora* and *R. gyalectiformis* to be synonyms. A view adopted by Ryan and Nimis (2004) for the treatment of species occurring in the Sonoran Desert Region. However Knudsen and Lendemer (2005) showed the species to be distinct based on ascospore characters and the size of the ascomata.

Recently while collecting in the San Jacinto Mountains of Southern California, the authors collected a specimen of *Ramonia* on decomposing granite in a montane oak-conifer forest, which they identified as *R. gyalectiformis* in the field despite the altitudinal and ecological disparity between the locality and the other known populations of *R. gyalectiformis* at lower elevations in arid or desert habitats. Subsequent microscopic examination of the material in the lab revealed it to have acicular rather than fusiform or ob-ovoid ascospores, and thus it represents an additional species of *Ramonia*, which is here described as *R. vermispora* Lendemer & K. Knudsen.

Materials And Methods

Apothecia were measured dry with a Bausch & Lomb StereZoom 7 dissecting microscope. Microscopic characters were measured in water with an Olympus BX51 microscope with an Olympus DP20 digital camera using Microsuite Special Edition. Photographs were taken with the same compound microscope, camera, and software outline above and prepared in Adobe Photoshop. Sections of the apothecia were prepared by hand cutting with a razor blade and mounted in water. Measurements are based on water mounts prior to the application of (10% KOH, or I). Chromatography was not performed because of the scant nature of the material.

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Summary of the status of Ramonia Ablephora And Ramonia Gyalectiformis

At present, *Ramonia gyalectiformis* is a rare species. It was described from a single Hasse collection (Zahlbruckner 1902) on sandy earth between rocks at the eastern base of the San Jacinto Mountains at 170 meters in the desert near Palm Springs. It is currently known only from two locations on the west side of the San Jacinto Mountains on decomposing granite at 748-827 meters in the chaparral belt of the San Jacinto Mountains of Southern California.

Ramonia ablephora is known only on the basis of historical collections on soil from the Santa Monica Mountains of Southern California in coastal habitats. There are no modern collections known, and the species may possibly occur and deserve special protection by public land management agencies when located.

The New Species

Ramonia vermispora Lendemer & K. Knudsen, ***sp. nov.***

Mycobank #511605.

Similis R. ablephorae, sed sporis acicularibus differt.

TYPE: U.S.A. California. Riverside Co.: Peninsular Range, San Bernardino National Forest, San Jacinto Mountains, Thomas Mountain, along Thomas Mountain Road, Anza Quad., 33° 35' 36" N, 116° 38' 16" W, elev. 1655 m., shaded granitic outcrop in oak-conifer woodland, on granite,11.i.2008, *J.C. Lendemer 11377 & K. Knudsen* (ny, holotype).

Description. – Thallus saxicolous, crustose, within substrate. Photobiont *Trentepohlia*. Apothecia 0.5-0.7 mm in diameter, irregular (scattered to +/- confluent in the material examined), at first immersed, becoming erumpent, black, often appearing greyish to +/- pruinose because of adhering thalline tissue, disc pale black-brown to grey, margin radially fissured. Exciple black, carbonized, 30-40-(50)um wide, thinner at base of hymenium, only inner-moist layer of cells distinct (i.e. not carbonized, dark brown, ~3-5um wide), inner surface lined with a thick pad of periphyses (~50um wide). Hymenium 80-110um tall, hyaline, I-. Asci cyindrical, 80-100 x 15-20um, [apical structures not fully examined because of lack of material], 8-spored. Ascospores acicular, transversely septate (3 septate, 4-celled), hyaline, +/- spirally arranged in the ascus, 45-60 x 3-4um. Periphyses ~2-2.5µm wide, with the uppermost cell slightly expanded. Hypothecium hyaline, thin, 30-40µm thick.

Etymology. – The epithet "vermispora" is derived from the worm-like appearance of the ascospores.

Substrate and Ecology. – *Ramonia vermispora* is presently known only from the type locality, a decomposing granite outcrop in a montane oak-conifer forest in the San Jacinto Mountains of Southern California, USA.

Discussion. – Despite the scarce material we have chosen to describe this species because of its potentially endemic nature and rarity, and the possibility that it may be taxonomically and phylogenetically informative with respect to the other two rare and endemic species of *Ramonia* known from southern California. *Ramonia vermispora* occurs in an ecologically different habitat than *R. gyalectiformis* (desert-arid) and *R. ablephora* (coastal) in the montane belt of the San Jacinto Mountains.

The new species is most similar to *R. ablephora* and *R. gyalectiformis* in the morphology of the apothecia (especially the exciple) and the saxicolous habit. It differs from those species however, primarily in having vermiform ascospores, a character shared by two corticolous European species of *Ramonia* namely *R. chrysophaea* (Pers.) Vězda, *R. subsphaeroides* (Tav.) Vězda. *Ramonia vermispora* is however, readily distinguished from all other species of *Ramonia* with fusiform or acicular ascospores by its saxiolcous habit, the size of the ascomata, and the spirally arranged acicular ascospores which are consistently 3-septate.

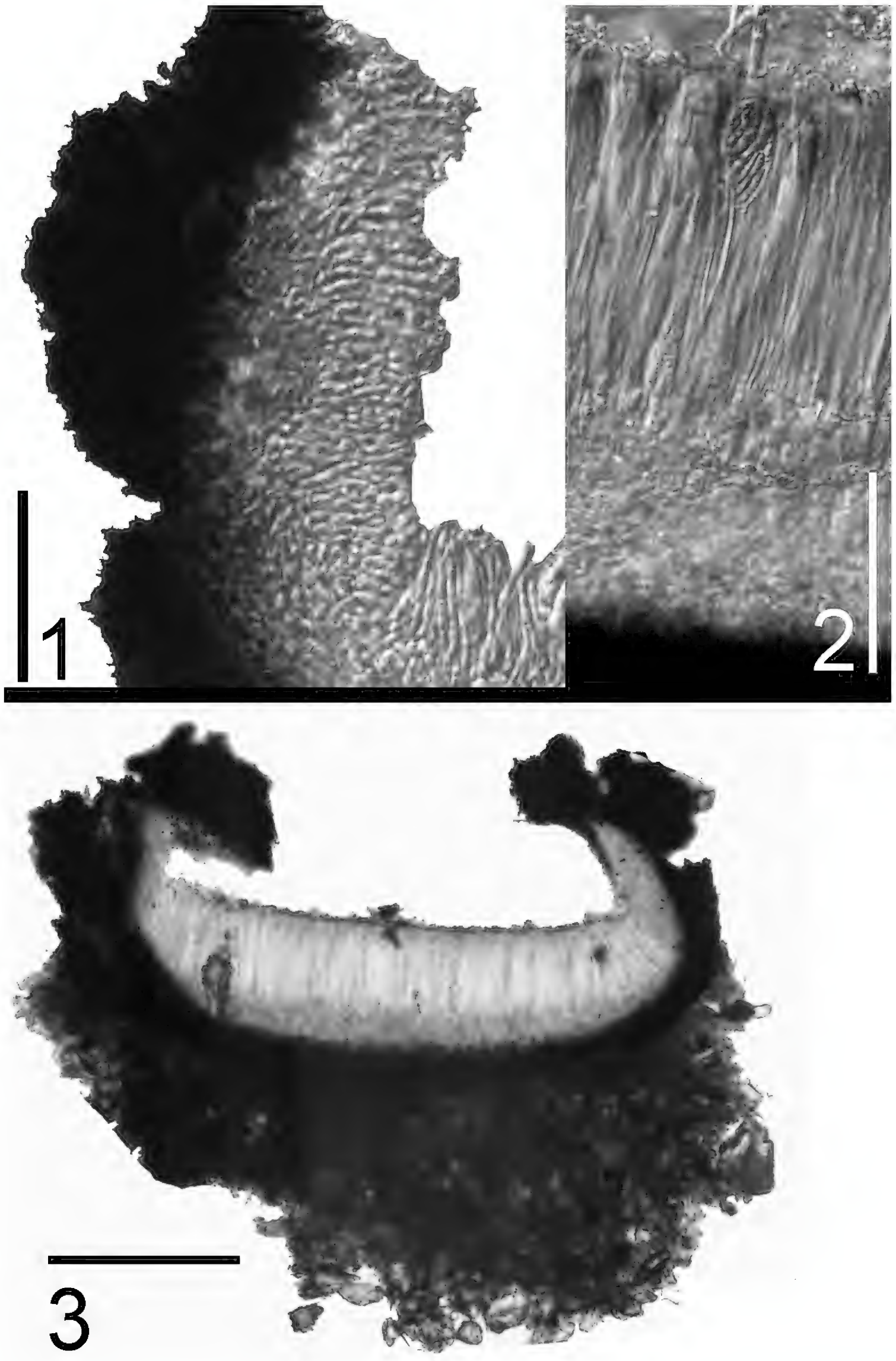

Plate 1. Figure 1, detail of carbonized exciple and periphysoid pad (scale bar = 50µm). **Figure 2**, section of apothecium showing detail of hymenium and hypothecium (scale bar = 50µm). **Figure 3**, section of apothecium (scale bar = 2ooµm).

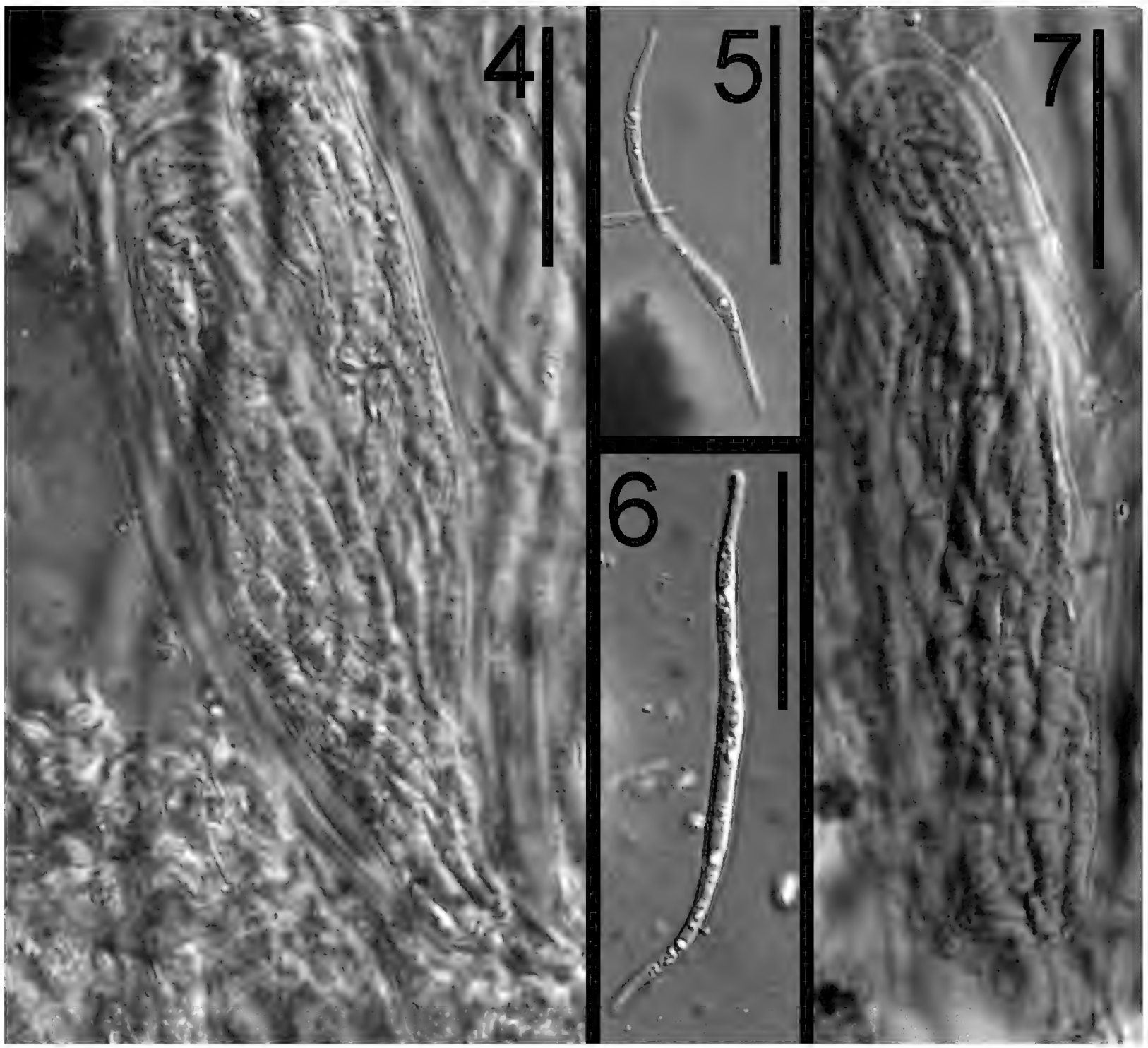

Plate 2. **Figure 4**, two asci with +/- spirally arranged ascospores (scale bar = 50µm). **Figures 5-6**, ascospores (scale bars = 20µm). **Figure 7**, ascus will well defined apical structure and and spirally arranged ascospores (scale bar = 50µm).

The brown radially fissured exciple places *Ramonia vermispora* in *Ramonia* sect. *Ramonia* following Vězda (1966). Both *R. ablephora* and *R. gyalectiformis* also belong to *Ramonia* sect. *Ramonia*. It should be noted Vězda (1966) defined *Ramonia* sect. *Ramonia* as having ellipsoid or ovoid ascospores, a character found in *R. ablephora* and *R. gyalectiformis* but not in *R. vermispora*. In fact, elongate ascospores similar to those of *R. vermispora* are characteristic of *Ramonia* sect. *Ramonidium* Vězda. We believe the excipular and ecological characters shared by *R. vermispora, R. ablephora,* and *R. gyalectiformis* outweigh the differences in ascospore shape/septation when considering the position of the new species in the current infrageneric framework of *Ramonia*.

Key to the Genus Ramonia

A key to the known species of *Ramonia* is presented below. Although largely based on data taken from the literature we feel it is helpful to present this information here, as there is presently no published summary of the genus. Note that *R. azorica* Purvis & P. James is not included here because it does not represent a species of *Ramonia* (T. Lumbsch pers. comm.).

1. Asci polysporous (>8 spores per ascus); all corticolous……..……2

2. Ascospores simple……..……..…3

3. Ascospores globose, 2.2-3.5µm in diameter; Africa……....*R. micrococca* Vězda
3. Ascospores ellipsoid……..……4

4. Ascospores <3µm wide, narrowly ellipsoid; Tropical Americas……...*R. microspora* Vězda
4. Ascospores ≥3µm wide; obtuse-ellipsoid; Brazil……..……5

5. Ascospores 4-6 x 3µm; apothecia 0.2-0.4mm in diameter, Brazil….*R. intermedia* Kalb
5. Ascospores 8-9 x 4-4.5µm; apothecia 0.2-0.6mm in diameter; Brazil..*R. kandlerii* Kalb

2. Ascospores septate to submuriform, not simple……..……..6

6. Ascospores 16-24-per ascus, 1-3-septate to submuriform, 9-14 x 4-5µm; Nepal… ……..……...*R. nepalensis* Thor & Vězda
6. Ascospores >16-24-per ascus, 1-3 septate, not from Nepal……...7

7. Ascospores 1-septate, 10-14 x 5-6µm; Tropical Americas…*R. valenzueliana* (Mont.) Stiz.
7. Ascospores more than 1-septate……..……8

8. Apothecia 0.4mm in diameter; ascospores 3-septate, 13-20 x 4-6µm; Sub-tropical North America……...*R. absconsa* (Tuck.) Vězda
8. Apothecia 0.3-0.6mm in diameter; ascospores 1-3 septate, 8-11-(12) x 4-6µm or 12-14-(16) x 5-6µm; Africa……..……..……*R. elixii* Kalb

1. Asci with 8 (or fewer) spores per ascus……..……9

9. Ascospores 1-per ascus, densely muriform; Papua New Guinea……..…..*R. monospora* Aptroot
9. Ascospores more than 1-per ascus……..…10

10. Ascospores vermiform to acicular (length:width ratio >10:1)……...11

11. Thallus corticolous; ascospores >8 septate……....12

12. Apothecia 0.2-0.4mm in diameter; ascospores 8-10 septate, 50-60 x 3-5µm; Portugal... ……...*R. subsphaeroides* (Tav.) Vězda
12. Apothecia 0.4-0.7mm in diameter; asocposres 8-14 septate; 45-75 x 3.5-4µm; Europe… ……...*R. chrysophaea* (Pers.) Vězda

11. Thallus saxicolous; ascospores 3-septate, 45-60 x 3-4µm; Southern California… ……...*R. vermispora* Lendemer & K. Knudsen

10. Ascospores ellipsoid to ob-ovoid or fusiform (length:width ratio <10:1)……..…13

13. Ascospores muriform; Europe……...14

14. Exciple black; ascospores 28-45-(50) x 8-13µm……..*R. nigra* Coppins
14. Exciple pale; ascospores 21-38-(45) x 9-14µm……*R. dictyospora* Coppins

13. Ascospores transversely septate; distribution various……15

15. Thallus saxicolous or terricolous; ascosposres 3-septate……..……16

16. Exciple pale; on calcareous rocks; ascospores fusiform, 18-23 x 4-6µm; Europe……..*R. calcicola* Canals & Gómez-Bolea
16. Exciple black; on non-calcareous rocks or soil; Southern California……..……17

17. Ascospores ob-ovate, 23-27 x 7-8µm…….....…*R. ablephora* (Nyl.) R.C. Harris
17. Ascospores fusiform, (17.5)-20-(25) x 5-6µ.....
.....*R. gyalectiformis* (Zahlbr.) Vězda

15. Thallus corticolous; septation various…....……18

18. Ascospores >3-septate, >20µm long……...19

19. Ascospores with perispore, 20-30 x 4-6µm; apothecia 0.25-0.4mm in diameter; Europe……..*R. luteola* Vězda
19. Ascospores without perispore, 24-43 x 4.5-7µm; apothecia 0.3-0.4mm in diameter; Europe……..*R. interjecta* Coppins

18. Ascospores 1-3-septate, <20µm long……..20

20. Ascospores 1-septate, 9-12 x 4-5µm, Tropical Americas…..*R. malmei* Vězda
20. Ascospores 3-septate……...21

21. Apothecia small, 0.1-0.2mm in diameter; ascospores narrowly ellipsoid; Australia……..….*R. leptospora* (Müll. Arg.) Vězda
21. Apothecia larger, >0.2mm in diameter; ascospores ovoid-ellipsoid…..22

22. Ascospores >15µm long; Australia……..*R. eungellae* Kalb
22. Ascospores <15µm long; non-Australian…….……..….23

23. Apothecia 0.5-0.7mm in diameter; Indonesdia + Brazil.....…
……..……*R. cupellina* Vězda
23. Apothecia 0.3-0.4mm in diameter; Florida, USA.....
.....*R. rappii* Vězda

Acknowledgments

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Monoblastiopsis (Dothideomycetes, Pleosporales, incertae sedis), a new genus from the Great Plains and Ozark Highlands

Richard C. Harris[1] & Caleb A. Morse[2]

ABSTRACT. – *Monoblastiopsis* is described as a new genus and with two new species, *M. konzana* and *M. nigrocortina*. *Monoblastiopsis* seems to represent a previously unrecognized group of perithecioid lichenized Dothideomycetes distinguished by chlorococcoid photobiont, superficial ascomata, periphysate ostioles, fissitunicate asci and nonseptate ascospores. It is saxicolous, known only from calcareous substrates in Colorado, Kansas, Missouri, and Texas. Descriptions and illustrations are provided.

Introduction

The lichen flora of the grassland biome of central North America has received little attention relative to the size of this large, physiographically diverse region. Recent publications amount to a handful of floristic reports and ecological studies (*e. g.*, Malone & Tiffany 1978, Dunlap & Tiffany 1980, Jackson & Hopkins 1980, Eversman 1982, Wetmore 1985, Egan et al. 1995, 2002, Will-Wolf 1998), a few post-graduate theses (*e. g.* Cherney 1985, Morgan 2001), and several web-accessible species lists (*e. g.* De Vries & Wright 2005, Burchill 2007). Wetmore's (1967) treatment for the Black Hills remains the sole published account with keys to the flora of a part of the Great Plains. As on-going work adds stations for poorly known species (Knudsen & Morse in review) and yields finds new to North America and new to science (Harris & Ladd 2007, Wetmore in review), however, a flora is emerging that combines elements from the better documented floras of eastern and southwestern North America with taxa apparently endemic to the Great Plains. As knowledge of the lichens of the Great Plains grows, it seems increasingly probable that many of the taxa thought to be endemic to the Ozark ecoregion will turn out to be the easternmost part of a Great Plains distributional pattern.

While carrying out fieldwork in eastern Kansas in 2005, the second author gathered specimens of a species thought at the time to be referable to *Monoblastia* Riddle. Considered examination of the material by the first author revealed that the taxon differed from *Monoblastia* in several important aspects, and appeared to represent a previously unrecognized group of lichenized Dothidiomycetes. Additional collecting in the High Plains in eastern Colorado and western Kansas turned up a second species, clearly allied to the first, but slightly smaller in several respects and occupying a different substrate.

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Taxonomic Section

Monoblastiopsis R.C. Harris & C.A. Morse, ***gen. nov.***
MycoBank #511606.

Monoblastia Riddle subsimilis quoad ascomata perithecioides et ascosporas nonseptatas sed algis chlorococcoidibus, ascomatis globosis superficialibus, ostiolis periphysatis et ascosporis biseriatis differt.

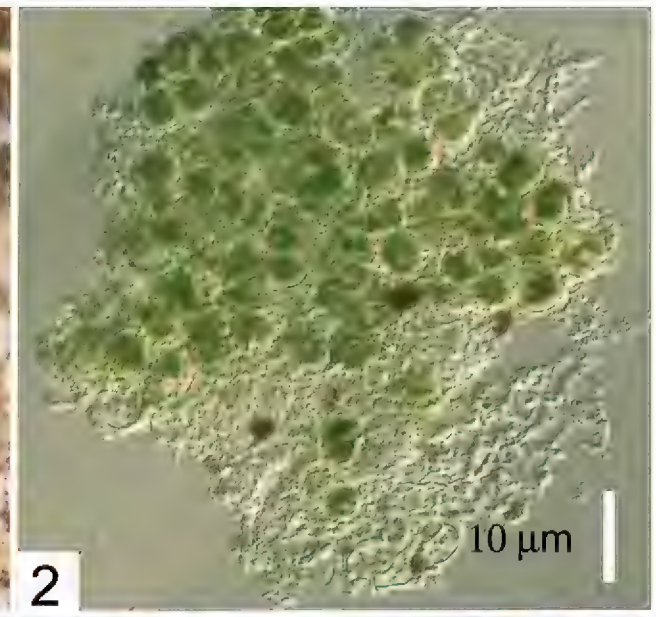
TYPE: *Monoblastiopsis konzana* R. C. Harris & C. A. Morse

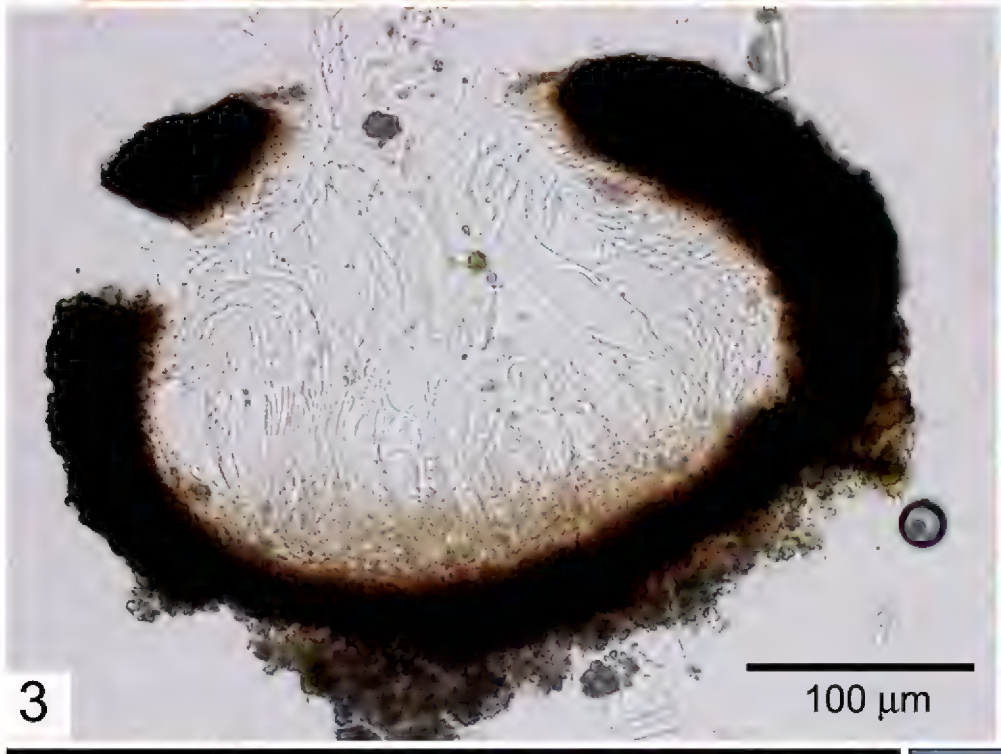
Description. - **Thallus** not evident, immersed in rock (rock surface often with extraneous cyanobacteria). **Photobiont** chlorococcoid (fig. 2), mostly in discontinuous clumps, with ± globose cells, 5–7 µm in diameter. **Ascomata** globose, often constricted at base, sessile or semi-immersed, rarely forming shallow pits in limestone, black, slightly shiny, solitary or confluent (figs. 1, 8), with conspicuous, open or sunken ostiole with short periphyses (fig. 4); ascomatal wall entire, hard and brittle when dry, composed of a single layer, formed of irregular cells with dark brown extracellular pigment. **Interascal hyphae** slender, branched and anastomosed pseudoparaphyses? arising from a brownish base; gel I–. Asci cylindrical to ± clavate, fissitunicate, thick-walled and with ocular chamber (fig. 5), with 8 spores. **Ascospores** nonseptate, colorless, ellipsoid to narrowly ellipsoid, without a halo, weakly ornamented at maturity (figs. 6, 9). **Pycnidia** globose, sessile or slightly immersed; pycnidial wall as in ascomata. **Conidiophores** branched (fig. 7). **Conidia** colorless, narrowly ellipsoid. **Chemistry** not studied but assumed to be nil.

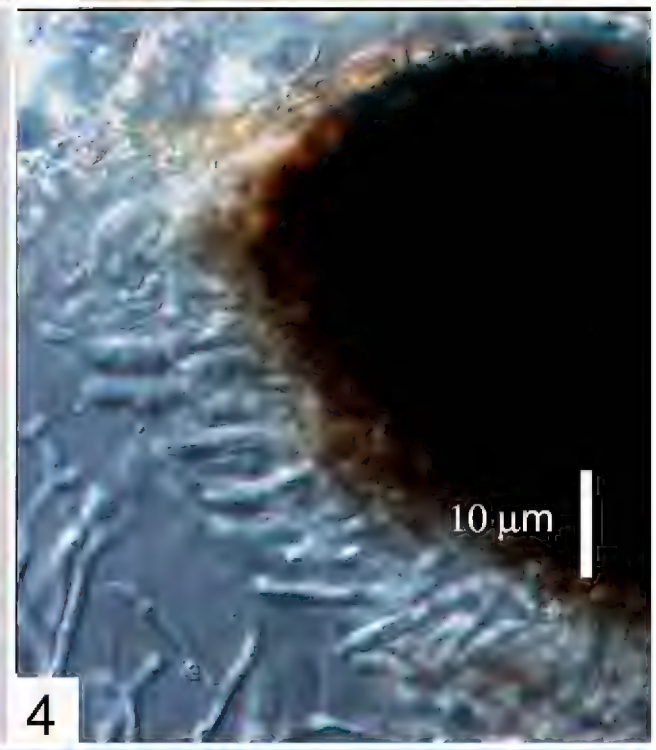
Discussion. - At first *Monoblastiopsis* was thought to belong to the Monoblastiaceae Watson, similar to *Monoblastia* in nonseptate spores, differing in ascus type (not narrowly cylindrical with uniseriate spores), and similar to *Anisomeridium* (Müll. Arg.) M. Choisy in ascus type, differing in having nonseptate spores. However, the presence of a chlorococcoid photobiont (*Trentepohlia* in Monoblastiaceae), periphysate ostioles, and branched conidiophores suggested otherwise. The Thelenellaceae H. Mayrhofer have a chlorococcoid photobiont but differ from *Monoblastiopsis* in ascus type and in muriform ascospores. Verrucariaceae Zenker differ in lacking interascal hyphae at maturity, iodine reaction, and ascus type. The best fit may be with lichenicolous genus *Zwackhiomyces* Grube & Hafellner. The ascospores of the majority of species of *Zwackhiomyces* are 1-septate but Hoffmann & Hafellner (2000) include *Z. lecanorae* (Stein) Nik. Hoffmann & Hafellner with nonseptate ascospores. However, in addition to being lichenicolous, *Zwackhiomyces* differs in lacking periphyses and in having narrowly bottle-shaped conidiogenous cells.

If one examines some of the larger gene trees of fungi (e.g., Hibbett et al. 2007), one notes that differing photobionts seem to be indicative of lichenization events. With the thought that *Monoblastiopsis* might represent an unrecognized lichenization event, a broader search beyond the usual suspects (above) was undertaken. Nonseptate ascospores are unusual in ascomycetes with fissitunicate asci but are typical in the Botryosphaeriaceae Theiss. & P. Syd. Beyond the similarity in spore type, there seem to be some other similarities to suggest placing *Monoblastiopsis* in the Botryosphaeriales Schoch, Crous & Shoemaker: the ascus type is similar (compare Cannon & Kirk 2007, p. 44) and although the conidial anamorphs of Botryosphaeriaceae are mostly different from the microconidia of *Monoblastiopsis*, Cannon & Kirk (2007) write "[a] conidial spermatial morph is also present in some species" (we have not seen any description of these). Although there seem to be similarities with the Botryosphaeriaceae, inclusion of *Monoblastiopsis* in the Botryosphaeriaceae s. str. seems to be precluded by its lichenization, occurrence on rock, superficial ascomata, structure of the ascomatal wall (pseudoparenchymatous in *Botryosphaeria*) and presence of periphyses. Since, at this point, it seems only remotely possible that *Monoblastiopsis* could be referred to the order Botryosphaeriales, one is left with the relatively meaningless option of last resort "Pleosporales M. E. Barr, incertae sedis" or perhaps Botryosphaeriales, incertae sedis. The systematic disposition of *Monoblastiopsis* and whether it represents a unique lichenization event awaits molecular study.

The two species so far known differ morphologically, in substrate preference and in distribution.







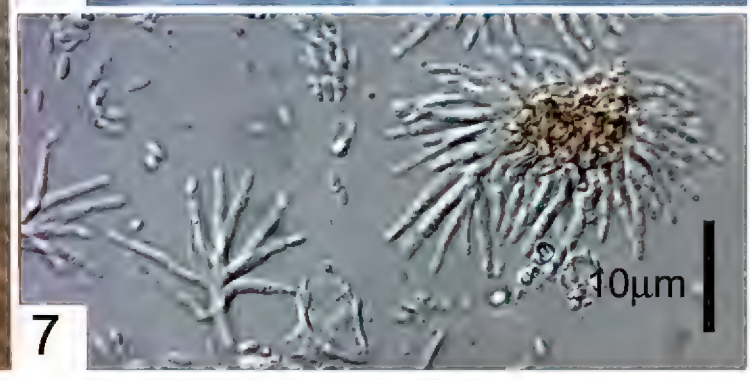


Plate 1. *Monoblastiopsis konzana. Morse 12339 & Barnard* (holotype). **Figure 1**. Habit. **Figure 2**. Photobiont (extracted from rock with HCl). **Figure 3**. Ascoma cross-section. **Figure 4**. Periphyses. **Figure 5**. Ascus. **Figure 6**. Ascospore. **Figure 7**. Conidiophores and conidia.

Key to the species

1. Asci broadly cylindrical to clavate with spores biseriately to irregularly arranged; ostiole periphysate; photobiont chlorococcoid 2
1. Asci narrowly cylindrical with spores uniseriately arranged; ostiole not periphysate; photobiont *Trentepohlia* ..... *Monoblastia*

2. Ascospores obtuse-ellipsoid, 19–29 x 8–13 µm; ascomata 0.2-0.5 mm in diameter, mostly solitary, not collapsed; asci with fewer than eight spores developing; pycnidia common ..... *M. konzana*
2. Ascospores narrow-ellipsoid 12–26 x 4.5–8 µm; ascomata 0.15–0.2 mm in diameter, often 2-5(-8) confluent, often collapsed and cup-like; asci with eight spores; pycnidia very rare....*M. nigrocortina*

Monoblastiopsis konzana R.C. Harris & C.A. Morse, ***sp. nov.***
MycoBank #511607.

PLATE 1, FIGURES 1-7.

Monoblastiopsis ascomatis 0.2-0.35 mm diametro, plerumque solitariis et ascosporis ellipsoideis, 19–29 x 8–13 µm.

Type: U.S.A. Kansas. Chase Co: 6.5 mi N, 2.5 mi W Strong City, Tallgrass Prairie National Preserve: N part, T18S R8E Section 7 SW¼ & section 18 NW¼, 38.4908°N–38.4949°N 96.5872°W–96.5927°W, 1330-1400 ft, 8.xi.2005, *Morse 12339 & Barnard* (KANU 371963, holotype; KANU 371964, NY, isotypes).

Description. - **Ascomata** globose, sessile, rarely forming shallow pits in limestone, black, slightly shiny, solitary or 2(–3) confluent, 0.2–0.35 mm in diameter, with conspicuous, open or sunken ostiole with short periphyses; ascomatal wall entire, ca. 40–60 µm thick. **Asci** cylindrical to ± clavate, initially with 8 spores but only (2–)4(–6) spores maturing. **Ascospores** ellipsoid to ± narrowly ellipsoid, weakly ornamented at maturity, 19-(24.7)-29 x 8-(10.5)-13 µm. **Pycnidia** common, globose. **Conidia** ca 3 x 1.5 µm.

Etymology. – *Monoblastiopsis* refers to the superficial resemblance of members of the genus to *Monoblastia*. The epithet *konzana* is derived from an older name for the Kaw Indians, who once occupied the area in Kansas from which the species is presently known. The Kaw were removed from their land in the mid nineteenth century. Today, the Kaw Nation is headquartered in Kaw City, Oklahoma.

Distribution and Ecology. – *Monoblastiopsis konzana* is presently known from the Flint Hills and Central Irregular Plains (Chapman et al. 2001) of eastern Kansas, from the White River Hills of the Ozark Highlands (Chapman et al. 2002) in Missouri, and from central Uvalde County, Texas, at elevations of 800–1400 ft (245–440 m). Both members of the genus are small and easily overlooked, and probably more common than collection records would suggest. Specimens of *M. konzana* have mostly been taken as admixtures with other species, however, so it remains difficult to make more than general comments about its ecology. All specimens examined for this study were from limestone. The type was collected in Flint Hills tallgrass prairie, from exposed outcrops of Permian Crouse, Funston, or Threemile limestones. Elsewhere in the Flint Hills, specimens were taken from limestone gravel atop weathered outcrops of the Beattie, Bader, or Crouse limestones, and from weathered boulders of Fort Riley Limestone, all of Permian age. Further east in Kansas, in the Osage Cuestas and Wooded Osage Plains of the Central Irregular Plains, the species has been found in open, second-growth riparian forest on shaded, east-facing outcrops of Pennsylvanian Plattsburg Limestone, in second-growth upland forest on shaded, south-facing outcrops of

Pennsylvanian Oread Limestone, and in prairie openings in disturbed sugar maple-basswood forest on boulders of limestone members of the Pennslyvanian Kansas City Group. The Missouri specimen was taken on shaded dolomite in oak-dominated hardwoods. The Texas specimen was collected from limestone of undetermined age in Tamaulipan thorn scrub at the northern edge of the Southern Texas Plains (Chapman et al. 2001). Associated species in exposed sites have included *Aspicilia contorta* (Hoffm.) Kremp., *Bagliettoa baldensis* (A. Massal) Gueidan & Roux, *Caloplaca atroalba* (Tuck.) Zahlbr., *C. variabilis* (Pers.) Müll. Arg., *Collema texanum* Tuck., *Kozarus thelommopsis* R. C. Harris & Ladd ined., *Lecanora valesiaca* (Müll. Arg.) Stizenb., *Leptogium apalachense* (Tuck.) Nyl., *Pachyphysis ozarkana* R. C. Harris & Ladd, *Peltula obscurans* (Nyl.) Gyel. var. *deserticola* (Zahlbr.) Wetm., *Phaeophyscia squarrosa* Kashiw., *Psora pseudorussellii* Timdal, *Rinodina bischoffii* (Hepp) A. Massal., and *Sarcogyne regularis* Körber. Associated species in shaded sites have included *Bacidia coprodes* (Körber) Lettau, *Caloplaca citrina* (Hoffm.) Th. Fr., *C. flavovirescens* (Wulfen) Dalla Torre & Sarnth., *Lecania perproxima* (Nyl.) Zahlbr., and *Verrucaria fayettensis* Servít.

Specimens examined. - **U.S.A. Kansas**. Anderson Co.: 1 mi N, 1.5 mi E Welda, University of Kansas Ecological Reserves, Welda Prairie Area Unit 3, T21S R20E Section 31 NE¼ NW¼, 38.1798°N 95.2552°W, 1040-1100 ft, 5.v.2005, *Morse 11208 & Freeman* (KANU); 1 mi N, 2 mi E Welda, University of Kansas Ecological Reserves, Welda Prairie Area Unit 3, T21S R20E Section 31 NE¼ NW¼, 38.1835°N 95.2555°W, 1040-1080 ft, 20.iv.2007, *Morse 15125 et al.* (KANU). Douglas Co.: 1 mi N, 2 mi E Midland, University of Kansas Ecological Reserves: Bluff Field (unit #2201): Botany Bluff, T12S R20W Section 4 NW¼ of NW¼ of NW¼, 39.0437°N 95.2052°W, 1040–1060 ft, 2.iii.2008, *Morse 16265 & Logan* (KANU, NY). Geary Co.: 4.25 mi S, 0.75 mi W Wreford, E side of Geary Co State Fishing Lake, T13S R5E Section 27 NE¼ NE¼, 38.8985°N 96.8546°W, 1230–1270 ft, 23.viii.2006, *Morse 13910a & Freeman* (KANU). Linn Co.: 2.75 mi W jct of KS Hwys 7 & 52 in Mound City, Dingus Natural Area, T22S R23E Section 15 NW¼ & Section 10 S½ SW¼, 38.1317°N–38.1408°N 94.8744°W–94.8758°W, 900-1010 ft, 7.v.2006, *Morse 12803* (KANU). Riley Co.: 5 mi S, 2.25 mi W jct of KS Hwy 177-18 & US Hwy 24 in Manhattan, Konza Prairie Biological Station units 13E, 13F, & 14F in vicinity of Nature Trail, T11S R7E Section 12 N½ SE¼, 39.1074°N–39.1097°N 96.6025°W–96.6017°W, 335-350 m, 16.iii.2006, *Morse 12611 & Morse* (KANU). **Missouri**. Ozark Co..: Mark Twain National Forest, along ridge E of Waterhole Hollow, T24N R16W Section 5, 36°47'25"N, 92°43'55"W, ca 610 m, 19.v.2003, *Buck 44399* (NY). **Texas**. Uvalde Co.: ca 6 mi S Sabinal, 29.2072°N 99.4672°W, 800-830 ft, 23.iv.2003, *Morse 9204C* (KANU).

Monoblastiopsis nigrocortina R.C. Harris & C.A. Morse, ***sp. nov.***

Mycobank #511608.

PLATE 2, FIGURES 8-9.

Similis Monoblastiopsi konzanae sed ascomatis minoribus aggregatis, saepe collapsis, ascosporis anguste ellipsoideis, 12–26 x 4.5–8 µm et pycnidiis rarissimis.

Type: U.S.A. Colorado. Kit Carson Co: ca 4 mi E of Flagler, Flagler Reservoir Wildlife Management Area, N end of reservoir along dam, T9S R50W Section 3 NW¼ SW¼, 39.2931°N 102.9584°W, 4710 ft, 3.x.2007, *Morse 15804* (KANU 377380, holotype; COLO, KANU 377381, NY, isotypes).

Description. - **Ascomata** ± globose, sessile, black, slightly shiny, solitary or often 2–5(–8) confluent, especially in cracks in sandstone, 0.15–0.2(–0.3) mm in diameter, often collapsing and cup-like with age, with conspicuous, open or sunken ostiole with short periphyses; ascomatal wall entire, ca. 20-30 µm thick. **Asci** cylindrical to ± clavate, initially with 8 spores. **Ascospores** narrowly ellipsoid, weakly ornamented at maturity, 12-(18.5)-26 x 4.5-(6.1)-8 µm. **Pycnidia** very rare (only one found). **Conidia** ca 4 x 1.5 µm.

Etymology. - The specific epithet *nigrocortina* (*nigro-* "black", *cortina* "kettle") honors Black Kettle (d. 1868), Chief of the Southern Cheyenne, one of several Native America tribes who occupied the area from which the species is presently known. Black Kettle struggled to secure peace between the Cheyenne and Euro-American settlers of the Great Plains and to maintain some independence for his people. The type specimen was collected approximately 60 mi (96 km) northwest of the site of the Sand Creek Massacre, where in 1864 some 200 Southern Cheyenne were killed when members of the Third Colorado Volunteers under John Chivington attacked their settlement. Black Kettle escaped this attack,

moving survivors to reservation lands in present-day Oklahoma. He and his wife, Medicine Woman Later, were killed by members of the 7th Cavalry under George Custer during the Washita Massacre.

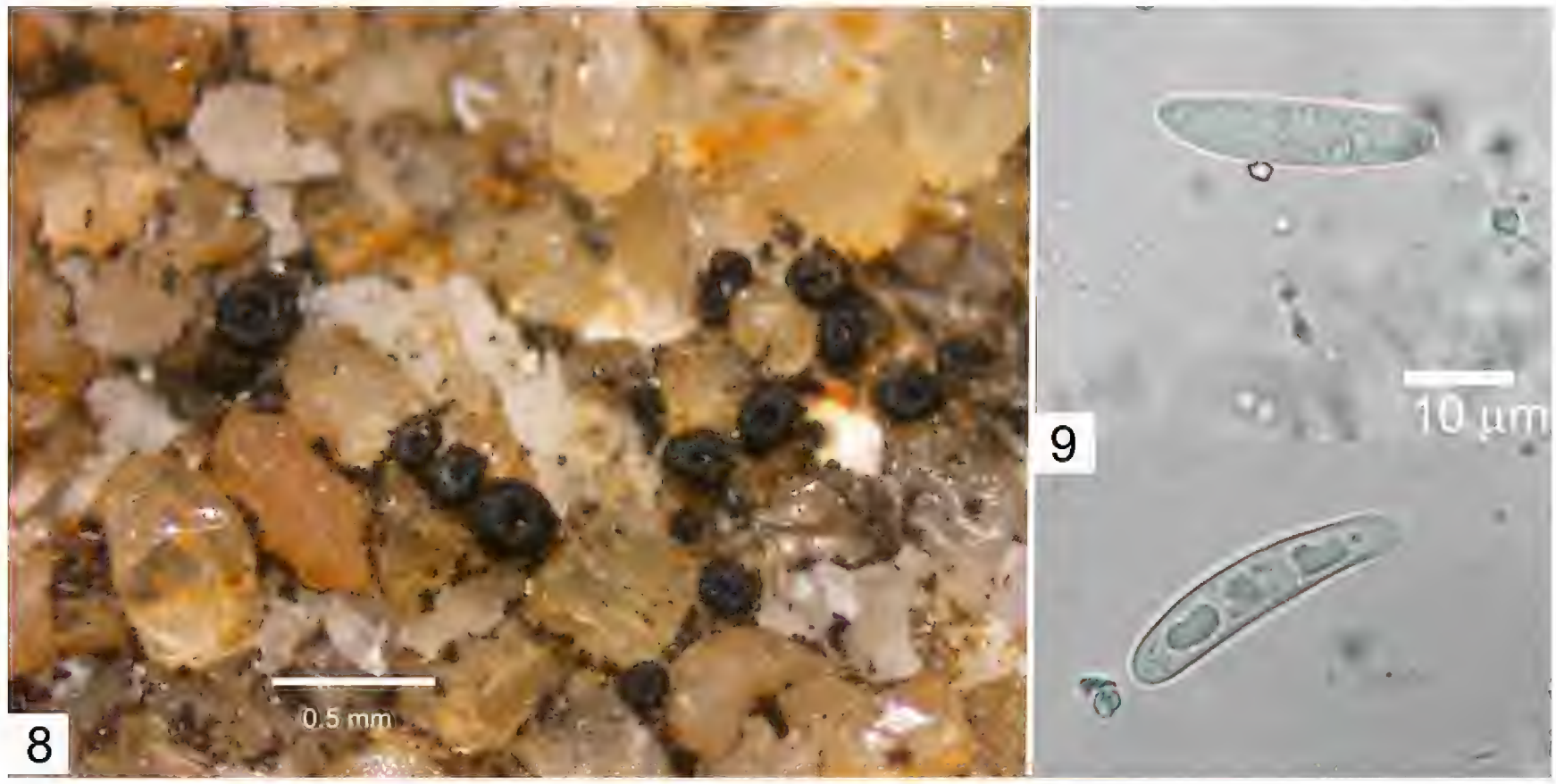


Plate 2. *Monoblastiopsis nigrocortina*. **Figure 8**. Habit (Kansas, Ford Co., *Morse 13956b & Freeman*). **Figure 9**. Ascospores (Kansas, Logan Co., *Morse 12340a & Freeman*).

Distribution and Ecology. - *Monoblastiopsis nigrocortina* is presently known from the Western High Plains ecoregion, and along the eastern edge of the Southwestern Tablelands and western edge of the Central Great Plains (Chapman et al. 2001) of western Kansas and eastern Colorado, at elevations of 2480–6240 ft (755–1901 m). Like its congener, however, the species is probably more common and more broadly distributed than collection records would suggest. All specimens examined for this study were from calcareous substrates. On coarser sandstones, *M. nigrocortina* is clearly associated with the cementing material, rather than the sand grains themselves. The type was collected from coarse, poorly cemented, sandstone riprap boulders of unknown provenance, but probably of the Tertiary Ogallala Formation. Elsewhere, the species has been found rarely on mortarbed boulders of the Ogallala Formation, and more frequently on sandstone boulders and outcrops. Three specimens were taken from coarse-grained sandstones of the Ogallala Formation or of unknown provenance and one from fine-grained sandstone assumed to be Jurassic or Triassic in age. Two specimens were collected from aging concrete blocks. Associated species have included *Acarospora strigata* (Nyl.) Jatta, *Caloplaca crenulatella* (Nyl.) H. Olivier, *C. pratensis* Wetmore ined., *Candelariella aurella* (Hoffm.) Zahlbr., *Collema coccophorum* Tuck., *C. fuscovirens* (With.) J. R. Laundon, *Lecanora crenulata* Hook., *L. dispersa* (Pers.) Sommerf., *Polysporina simplex* (Davies) Vězda, *Psorotichia schaereri* (A. Massal.) Arnold, *Rinodina bischoffii* (Hepp) A. Massal., *Sarcogyne dakotensis* H. Magn., *S. similis* H. Magn., and *Staurothele elenkinii* Oksn.

Specimens examined. - **U.S.A. Colorado**. El Paso Co.: 1.5 mi S, 2.5 mi W Ramah, W and N side of Ramah Reservoir State Wildlife Area, T11S R61W Section 10 S½ SW¼ & Section 15 N½ NW¼, 39.0957°–39.1024°N 104.2189–104.2106°W, 6180–6240 ft, 4.x.2007, *Morse 15832b* (kanu). Lincoln Co.: 1.25 mi S, 1.5 mi E Karval, S side Karval Reservoir State Wildlife Area, T15S R55W Section 25 N½ SE¼ NW¼ & N½ SW¼ NE¼, 38.7151°N 103.5079°W, 5000-5080 ft, 5.x.2007, *Morse 15968 & Ladd* (kanu, ny). **Kansas**. Ford Co.: S side Dodge City, near Ford Co Rodeo and Fair Grounds along Arkansas River, T26S R25W Section 35 SE¼ NW¼, 37.7460°N 100.0268°W, 2480 ft, 23.viii.2006, *Morse 13956b & Freeman* (kanu). Hamilton Co.: 3.5 mi N, 3.5 mi W Syracuse, S side Hamilton Co State Fishing Lake and Wildlife Area, T23S R41W Section 21 SW¼ SE¼ & Section 28 NE¼, 38.0229°N–38.0320°N

101.8198°W–101.8225°W, 3320-3360 ft, 9.x.2007, *Morse 16119a* (KANU). LOGAN CO.: 17.5 mi S, 8 mi W Oakley, Smoky Valley Ranch (TNC preserve), T13S R33W section 33 SW¼ & T14S R33W Section 5 N½, 38.8742°N–38.8694°N 100.9994°W–100.0116°W, 2780-2850 ft, 10.xi.2005, *Morse 12430a & Freeman* (KANU). MORTON CO.: 6.5 mi N, 2 mi W of N edge of Elkhart, Cimarron National Grasslands in vicinity of Point of Rocks, T34S R43W Section 12 N½ SE¼, 37.1038°N–37.1036°N 101.9383°W–101.9410°W, 3430-3540 ft, 27.vi.2006, *Morse 13361b & Freeman* (KANU); ca 5 mi N, 6 mi W of N edge Elkhart, Cimarron National Grasslands, T34S R43W Section 17 SE¼, 37.0869°N 102.0128°W, 3560-3590 ft, 27.vi.2006, *Morse 13393e & Freeman* (KANU). SHERMAN CO.: 10.25 mi S, 2.75 mi W jct of KS Hwy 27 & US Hwy Business 24 in Goodland, NW side Sherman Co State Fishing Lake and Wildlife Area, T10S R40W Section 15 W½ NW¼ & Section 16 NE¼ NE¼, 39.1850°–39.1887°N 101.7778°–101.7823°W, 3620–3680 ft, 27.vi.2007, *Morse 15590b & Elliott* (KANU).

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Lichens of Eastern North America Exsiccati, Fascicle VI, Nos. 251-300.

James C. Lendemer[1]

ABSTRACT. – Data for the sixth fascicle, comprising the nos. 251 to 300, of *Lichens of Eastern North America Exsiccati* is presented. The fascicle is distributed to ASU, B, BG, CANB, CHR, DOV, FH, GZU, H, HMAS, M, MIN, NY, S, TSB, TNS, TU, and UPS.

Introduction

In conjunction with the author's work on the lichen biota of eastern North America he began the distribution of this series (*Lichens of Eastern North America Exsiccati*) from the Academy of Natural Sciences of Philadelphia (PH). This, the sixth fascicle in the series is distributed from the New York Botanical Garden (NY) where the author is now employed. This fascicle comprises the nos. 251-300, and is distributed in 20 sets on exchange to the following herbaria: ASU, B, BG, CANB, CHR, DOV, FH, GZU, H, HMAS, M, MIN, NY, S, TSB, TNS, TU, and UPS. Incomplete sets are distributed to UCR and PRM.

Fascicle VI

251. *Lecidella euphorea* (Flörke) Hertel
Det. Caleb Morse - 30.August.2007

UNITED STATES OF AMERICA. NORTH DAKOTA. OLIVER COUNTY.: Ca. 2 mi S, 4 mi E of Hensler, The Nature Conservancy's Cross Ranch Preserve, Sangor Ghost Town. – elev. ca. 1690 ft. - Lat. 47° 10' 48" N, Long. 100° 59' 42" W – Gentle slopes of mixed grass prairie, Missouri River Valley and floodplain. - On old wooden shingles of roof collapsed to ground level, basement intact below, dripline and shade of trees overhead.

M.K. Advaita **#6117** 5.June.2007

252. *Strangospora moriformis* (Ach.) Stein
Det. Caleb Morse - 30.August.2007

UNITED STATES OF AMERICA. NORTH DAKOTA. OLIVER COUNTY.: Ca. 2 mi SE of Hensler, The Nature Conservancy's Cross Ranch Preserve. – elev. ca. 1700 ft. - Lat. 47° 14.83' N, Long. 101° 03.22' W – Gentle slopes of mixed grass prairie, Missouri River Valley and floodplain. – On wood of 100-year-old cedar posts.

M.K. Advaita **#5896** 1.June.2007

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253. *Candelariella vitellina* (Hoffm.) Müll. Arg.

UNITED STATES OF AMERICA. SOUTH DAKOTA. MCPHERSON COUNTY.: Ca. 11 mi W and 2 mi S of Leola, private land adjacent to west border of The Nature Conservancy's Ordway Preserve. – elev. ca. 1900 ft. - Lat. 45° 42.52' N, Long. 99° 09.46' W – Old homestead site, mature planted cottonwood "park", rolling pasture and shelterbelts, prairie pothole wetlands and glacial erratics. – On wooden shingles from collapsing homestead cabin.

M.K. Advaita **#5437** 29.April.2007

254. *Trapeliopsis flexuosa* (Fr.) Coppins & P. James
Det. Caleb Morse - 30.August.2007

UNITED STATES OF AMERICA. NORTH DAKOTA. OLIVER COUNTY.: Ca. 2 mi S, 4 mi E of Hensler, The Nature Conservancy's Cross Ranch Preserve, Sangor Ghost Town. – elev. ca. 1690 ft. - Lat. 47° 10' 48" N, Long. 100° 59' 42" W – Gentle slopes of mixed grass prairie, Missouri River Valley and floodplain. – On wood of 14"-diameter decaying log on ground.

M.K. Advaita **#6128** 6.June.2007

255. *Aspicilia cinerea* (L.) Körber
Det. Caleb Morse - 30.August.2007

UNITED STATES OF AMERICA. NORTH DAKOTA. OLIVER COUNTY.: Ca. 2 mi S, 4 mi E of Hensler, The Nature Conservancy's Cross Ranch Preserve, Sangor Ghost Town. – elev. ca. 1690 ft. - Lat. 47° 10' 48" N, Long. 100° 59' 42" W – Gentle slopes of mixed grass prairie, Missouri River Valley and floodplain. – On old wooden shingles of roof collapsed to ground level, basement intact below, dripline and shade of tree overhead.

M.K. Advaita **#6119** 5.June.2007

256. *Placynthiella icmalea* (Ach.) Coppins & P. James
Det. Caleb Morse - 30.August.2007

UNITED STATES OF AMERICA. NORTH DAKOTA. RANSOM COUNTY.: Ca. 7 mi N, 4 mi W of McCleod, The Nature Conservancy's Pigeon Point Preserve. – elev. ca. 1050 ft. - Lat. 46° 29.96' N, Long. 97° 23.17' W – Riparian and wetland hardwood forest of the Sheyenne River Valley. – On wood of charred log on ground.

M.K. Advaita **#5653** 9.May.2007

257. *Strangospora microhaema* (Norman) R. Anderson

UNITED STATES OF AMERICA. SOUTH DAKOTA. MCPHERSON COUNTY.: Ca. 10 mi W, ½ mi S of Leola, The Nature Conservancy's Ordway Preserve, headquarters. – elev. ca. 1900 ft. - Lat. 45° 42.89' N, Long. 99° 07.89' W – Rolling mixed grass prairie, glacial erratics, pothole wetlands. – On bark of 3 ft. dbh cottonwood windfall of old shelterbelt.

M.K. Advaita **#5278** 25.April.2007

258. *Piccolia ochrophora* (Nyl.) Hafellner

UNITED STATES OF AMERICA. SOUTH DAKOTA. MCPHERSON COUNTY.: Ca. 10 mi W, ½ mi S of Leola, The Nature Conservancy's Ordway Preserve, headquarters. – elev. ca. 1900 ft. - Lat. 45° 42.89' N, Long. 99° 07.89' W – Rolling mixed grass prairie, glacial erratics, pothole wetlands. – On bark of 3 ft. dbh cottonwood windfall of old shelterbelt.

M.K. Advaita **#5284** 25.April.2007

259. *Candelariella antennaria* Räsänen
Det. Caleb Morse – 30.August.2007

UNITED STATES OF AMERICA. NORTH DAKOTA. OLIVER COUNTY.: Ca. 2 mi S, 4 mi E of Hensler, The Nature Conservancy's Cross Ranch Preserve, Sangor Ghost Town. – elev. ca. 1690 ft. - Lat. 47° 10' 48" N, Long. 100° 59' 42" W – Gentle slopes of mixed grass prairie, Missouri River Valley and floodplain. – On 8" dbh green ash growing up from drainage ditch, shaded on S side by bridge.

M.K. Advaita **#6091** 4.June.2007

260. *Cliostomum griffithii* (Sm.) Coppins

UNITED STATES OF AMERICA. MAINE. WASHINGTON COUNTY.: Town of Beals, Great Wass Island, Great Wass Island Preserve, Little Cape Point Trail. – Lat. 44° 28' 52" N, Long. 67° 35' 41" W – Red spruce – balsam fir coastal forest and jack pine bald. – On trunk of standing dead *Abies balsaminea*.

Richard C. Harris **#53800** 11.July.2007

261. *Aspicilia moenium* (Vainio) Thor & Timdal

UNITED STATES OF AMERICA. NORTH DAKOTA. OLIVER COUNTY.: Ca. 2 mi S, 4 mi E of Hensler, The Nature Conservancy's Cross Ranch Preserve, Sangor Ghost Town. – elev. ca. 1690 ft. - Lat. 47° 10' 48" N, Long. 100° 59' 42" W – Gentle slopes of mixed grass prairie, Missouri River Valley and floodplain. – On crumbling vertical concrete lining of drainage ditch.

M.K. Advaita **#6090** 4.June.2007

262. *Physcia subtilis* Degel.
Det. J.C. Lendemer, 2007

UNITED STATES OF AMERICA. NEW YORK. GREENE COUNTY.: Catskill Mountains, north end of Mink Hollow and west slope of Sugarloaf Mountain, ~6.5 miles north of Shady, Hunter Quad. – elev. 2200-2700 ft. – Lat. 42° 08' 06" N, Long. 74° 09' 44" W – Mixed hardwood (*Acer, Betula* dominate) – conifer forest with large rock outcrops and rocky seeps. – On sandstone boulder.

James C. Lendemer **#9737** & Andy Moroz 8.October.2007

263. *Leptogium cyanescens* (Rabenh.) Körber
Det. J.C. Lendemer, 2007

UNITED STATES OF AMERICA. NEW YORK. GREENE COUNTY.: Catskill Mountains, north end of Mink Hollow and west slope of Sugarloaf Mountain, ~6.5 miles north of Shady, Hunter Quad. – elev. 2200-2700 ft. – Lat. 42° 08' 06" N, Long. 74° 09' 44" W – Mixed hardwood (*Acer, Betula* dominate) – conifer forest with large rock outcrops and rocky seeps. – On the trunk of a large maple (*Acer*).

James C. Lendemer **#9738** & Andy Moroz 8.October.2007

264. *Phaeophyscia ciliata* (Hoffm.) Moberg

UNITED STATES OF AMERICA. SOUTH DAKOTA. GRANT COUNTY.: ca 1 mi E of Marvin, Blue Cloud Benedictine Abbey. – elev. ca. 1530 ft. - Lat. 45° 15.18' N, Long. 96° 53.47' W – Open pastureland, wooded gulches, abundant glacial till (Altamont moraine). – On bole and branches of recently blown-down 14" dbh box elder.

M.K. Advaita **#6489** 20.September.2007

265. *Caloplaca cerina* (Ehrh. *ex* Hedwig) Th. Fr.

UNITED STATES OF AMERICA. SOUTH DAKOTA. GRANT COUNTY.: ca 1 mi E of Marvin, Blue Cloud Benedictine Abbey. – elev. ca. 1530 ft. - Lat. 45° 15.18' N, Long. 96° 53.47' W – Open pastureland, wooded gulches, abundant glacial till (Altamont moraine). – On peeling bark plates of standing-dead 18" dbh box elder.

M.K. Advaita **#6491** 27.September.2007

266. *Candelaria fibrosa* (Fr.) Müll. Arg.

UNITED STATES OF AMERICA. SOUTH DAKOTA. GRANT COUNTY.: ca 1 mi E of Marvin, Blue Cloud Benedictine Abbey. – elev. ca. 1530 ft. - Lat. 45° 15.18' N, Long. 96° 53.47' W – Open pastureland, wooded gulches, abundant glacial till (Altamont moraine). – On bole and branches of recently blown-down 14" dbh box elder.

M.K. Advaita **#6488** 20.September.2007

267. *Candelariella antennaria* Räsänen

UNITED STATES OF AMERICA. SOUTH DAKOTA. GRANT COUNTY.: ca 1 mi E of Marvin, Blue Cloud Benedictine Abbey. – elev. ca. 1530 ft. - Lat. 45° 15.18' N, Long. 96° 53.47' W – Open pastureland, wooded gulches, abundant glacial till (Altamont moraine). – On peeling bark plates of standing-dead 18" dbh box elder.

M.K. Advaita **#6492** 27.September.2007

268. *Caloplaca ulcerosa* Coppins & P. James

UNITED STATES OF AMERICA. SOUTH DAKOTA. GRANT COUNTY.: ca 1 mi E of Marvin, Blue Cloud Benedictine Abbey. – elev. ca. 1530 ft. - Lat. 45° 15.18' N, Long. 96° 53.47' W – Open pastureland, wooded gulches, abundant glacial till (Altamont moraine). – On peeling bark plates of standing-dead 18" dbh box elder.

M.K. Advaita **#6490** 27.September.2007

269. *Xanthomendoza fallax* (Hepp) Arnold

UNITED STATES OF AMERICA. SOUTH DAKOTA. MINNEHAHA COUNTY.: ca 3 mi E of Sioux Falls on Hwy. 42, Perry Nature Area. – elev. ca. 1250 ft. - Lat. 43° 31.74' N, Long. 96° 36.48' W – Riparian deciduous forest and wooded park near Big Sioux River. – On bole of recently felled 14" dbh hackberry.

M.K. Advaita **#6496** 11.October.2007

270. *Candelaria concolor* (Dickson) Stein

UNITED STATES OF AMERICA. SOUTH DAKOTA. MINNEHAHA COUNTY.: ca 3 mi E of Sioux Falls on Hwy. 42, Perry Nature Area. – elev. ca. 1250 ft. - Lat. 43° 31.74' N, Long. 96° 36.48' W – Riparian deciduous forest and wooded park near Big Sioux River. – On bole of recently felled 14" dbh hackberry.

M.K. Advaita **#6497** 11.October.2007

271. *Lobaria scrobiculata* (Scop.) P. Gaertn.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Avalon Peninsula, Hall's Gully, 9.7 km W of Trans-Canada Highway on Fox Marsh Resource Road, 5.5 km S on Hall's Gully Road. – elev. ca. 100 m. – Lat. 47° 21' 56" N, Long. 53° 26' 59" W – *Picea mariana – Abies balsamea* forest with sparse *Betula*, adjacent to open peatland. – On conifer bark.

James C. Lendemer **#10130** 8.September.2007

272. *Lecanactis abietina* (Ach.) Körber
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Avalon Peninsula, Hall's Gully, 9.7 km W of Trans-Canada Highway on Fox Marsh Resource Road, 5.5 km S on Hall's Gully Road. – elev. ca. 100 m. – Lat. 47° 21' 56" N, Long. 53° 26' 59" W – *Picea mariana – Abies balsamea* forest with sparse *Betula*, adjacent to open peatland. – On dead, standing conifer trunk.

James C. Lendemer **#10128** 8.September.2007

273. *Sphaerophorus globosus* (Huds.) Vainio
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Avalon Peninsula, Hall's Gully, 9.7 km W of Trans-Canada Highway on Fox Marsh Resource Road, 5.5 km S on Hall's Gully Road. – elev. ca. 100 m. – Lat. 47° 21' 56" N, Long. 53° 26' 59" W – *Picea mariana – Abies balsamea* forest with sparse *Betula*, adjacent to open peatland. – On conifer bark.

James C. Lendemer **#10066** 8.September.2007

274. *Chrysothrix insulizans* R.C. Harris & Ladd
Det. R.C. Harris, 2007

UNITED STATES OF AMERICA. GEORGIA. ROCKDALE COUNTY.: Panola Mountain State Park, middle-low slopes of Panola Mountain, ~3 miles southwest of Klondike, Redan Quad. – elev. ca. 700-940 ft. – Lat. 33° 38' 05" N, Long. 84° 10' 18" W – Extensive open granite outcrop on upper slopes, massive outcrops and boulders on lower slopes with mixed hardwood (*Acer* dominant) – pine (*Pinus*) forest in drainage to lake. – On undersides of granite exposures and boulders, associated with *Lepraria*.

James C. Lendemer **#9003** 17.April.2007

275. *Arthrorhaphis citrinella* (Ach.) Poelt
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Avalon Peninsula, Butterpot Provincial Park, east side of Big Otter Pond, along cross-country ski-trail between parking area and east-flowing stream-outlet from pond. – elev. ca. 160 m. – Lat. 47.399° N, Long. 53.043° W – Mesic to wet coniferous forest dominated by *Picea mariana*, with *Betula cordifolia*, *Sorbus americana*, and large glacial erratics adjacent to outlet brook. – On soil and roots of upturned tree.

James C. Lendemer **#10201** 9.September.2007

276. *Schaereria fuscocinerea* (Nyl.) Clauzade & Cl. Roux
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Avalon Peninsula, Bay Roberts East Shoreline Heritage Walk, between Mad Rock and Long Point. – elev. ca. 50 m. - Lat. 53° 12' 12" N, Long. 47° 37' 11" W – Shaley rocks along coastal shoreline and rocky open heath. – On rock.

James C. Lendemer **#10275** 10.September.2007

277. *Parmelia sulcata* Taylor
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Avalon Peninsula, Bay Roberts East Shoreline Heritage Walk, between Mad Rock and Long Point. – elev. ca. 50 m. - Lat. 53° 12' 12" N, Long. 47° 37' 11" W – Shaley rocks along coastal shoreline and rocky open heath. – On rock.

James C. Lendemer **#10308** 10.September.2007

278. *Parmelia saxatilis* (L.) Ach.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Avalon Peninsula, Bay Roberts East Shoreline Heritage Walk, between Mad Rock and Long Point. – elev. ca. 50 m. - Lat. 53° 12' 12" N, Long. 47° 37' 11" W – Shaley rocks along coastal shoreline and rocky open heath. – On rock.

James C. Lendemer **#10314** 10.September.2007

279. *Stereocaulon tomentosum* Th. Fr.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Avalon Peninsula, Burry Heights Center. – Lat. 47° 20' 49" N, Long. 53° 13' 08" W – *Picea mariana – Abies balsamea* forest with sparse *Betula*, with gravelly openings and a lake. – On soil in gravelly opening.

James C. Lendemer **#10394** 7.September.2007

280. *Peltigera hymenina* (Ach.) Delise
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Avalon Peninsula, Burry Heights Center. – Lat. 47° 20' 49" N, Long. 53° 13' 08" W – *Picea mariana – Abies balsamea* forest with sparse *Betula*, with gravelly openings and a lake. – On mossy banks of lake.

James C. Lendemer **#10397** 7.September.2007

281. *Cladonia rei* Schaer.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Avalon Peninsula, Burry Heights Center. – Lat. 47° 20' 49" N, Long. 53° 13' 08" W – *Picea mariana – Abies balsamea* forest with sparse *Betula*, with gravelly openings and a lake. – On soil in gravelly opening.

James C. Lendemer **#10404** 7.September.2007

282. *Leptogium isidiosellum* (Riddle) Sierk
Det. J.C. Lendemer, 2007

UNITED STATES OF AMERICA. NORTH CAROLINA. CLAY COUNTY.: Nantahala National Forest, stream bed/valley of Buck Creek, 1-1.5 mi N of US 64 on Buck Creek Rd., ~5 mi NE of Shooting Creek, Rainbow Springs Quad. – elev. 3300-3400 ft. – Lat. 35° 05' 07" N, Long. 83° 37' 01" W – Riparian forest (*Betula, Tsuga, Acer*) with *Rhododendron* under story and rocky stream margins. – On *Cornus*.

James C. Lendemer *et al.* **#10475** 10.November.2007
w/ Sean Q. Beeching & Malcolm Hodges

283. *Parmelia omphalodes* (L.) Ach.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Ha-Ha Mountain, west slopes/cliffs facing the Straits of Belle Isle, north of Raleigh. – Lat. 51° 33' 48" N, Long. 55° 42' 38" W – Steep, moist, rocky (Ordovician lava and ash) slopes exposed to the sea. – On rock.

James C. Lendemer **#10541** & Andy Moroz 20.August.2007

284. *Alectoria vexillifera* (Nyl.) Stizenb.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, hills above town of Quirpon. – Lat. 51° 34' 44" N, Long. 55° 26' 40" W – Extensive rocky ridge top ("Mélange" of basalt, diabase, gabbro, ultramafic rock, enclosed in shale) with boggy, peaty, depressions. – On rock and organic matter.

James C. Lendemer **#10680** & Andy Moroz 18.August.2007

285. *Alectoria nigricans* (Ach.) Nyl.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, hills above town of Quirpon. – Lat. 51° 34' 44" N, Long. 55° 26' 40" W – Extensive rocky ridge top ("Mélange" of basalt, diabase, gabbro, ultramafic rock, enclosed in shale) with boggy, peaty, depressions. – On rock.

James C. Lendemer **#10654** & Andy Moroz 18.August.2007

286. *Gyalideopsis buckii* Lücking, Sérus. & Vezda
Det. J.C. Lendemer, 2007

UNITED STATES OF AMERICA. ALABAMA. ESCAMBIA COUNTY.: Conecuh National Forest, south of US 29 just east of McGowin Bridge over the Conecuh River, Damascus Quad. – elev. 110 ft. - UTM 16 519405E 3447660N – Lat. 31° 09' 46"N, Long. 86° 47' 47"W – Planted *Taxodium* trees on edge of mixed pine (*Pinus*) – oak (*Quercus*) – tupelo (*Nyssa*) bottomland and sand scrub. – On *Taxodium* branches.

James C. Lendemer *et al.* **#9374** 13.April.2007

287. *Opegrapha astraea* Tuck.
Det. J.C. Lendemer, 2007

UNITED STATES OF AMERICA. ALABAMA. COVINGTON COUNTY.: Conecuh National Forest, Solon Dixon Forestry Education Center, Blue Springs, Dixie Quad. – elev. 150-200 ft. - UTM 16 528801E 3448235N – Lat. 31° 10' 04"N, Long. 86° 41' 52"W – Narrow calcareous stream gorge with mesic hardwood (*Acer, Ilex, Nyssa, Quercus*) forest. – On *Nyssa*.

James C. Lendemer *et al.* **#9374** 14.April.2007

288. *Ramalina stenospora* Müll. Arg.
Det. J.C. Lendemer, 2007

UNITED STATES OF AMERICA. ALABAMA. BALDWIN COUNTY.: Bay Minette. Baldwin County Department of Human Resources on US 31. – Lat. 30° 51' 23"N, Long. 87° 46' 32"W – On trees in parking lot.

James C. Lendemer *et al.* **#9267** 11.April.2007

289. *Cladonia sandstedei* Abbayes
Det. J.C. Lendemer, 2007

UNITED STATES OF AMERICA. ALABAMA. ESCAMBIA COUNTY.: Conecuh National Forest, Solon Dixon Forestry Education Center, Auburn Center, Dixie Quad. – elev. 200 ft. - UTM 16 528403E 3447836N – Lat. 31° 09' 51"N, Long. 86° 42' 07"W – Old homestead with large planted trees, old fences, and small openings of sandy pine (*Pinus*) – oak (*Quercus*) scrub. – On sandy soil.

James C. Lendemer *et al.* **#9464** 13.April.2007

290. *Fuscopannaria praetermissa* (Nyl.) P.M. Jørg.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Watts Point Ecological Preserve, north end of Preserve, south of Big Brook, north of Eddies Cove. – Lat. 51° 27' 40" N, Long. 56° 15' 31" W – Coastal (Cambrian) limestone/dolostone barren with low heathland along beach. – On organic matter in heath community.

James C. Lendemer **#10700** & Andy Moroz 17.August.2007

291. *Lecanora epibryon* (Ach.) Ach.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Watts Point Ecological Preserve, north end of Preserve, south of Big Brook, north of Eddies Cove. – Lat. 51° 27' 40" N, Long. 56° 15' 31" W – Coastal (Cambrian) limestone/dolostone barren with low heathland along beach. – On organic matter and soil in heath community.

James C. Lendemer **#10755** & Andy Moroz 17.August.2007

292. *Ramalina farinacea* (L.) Ach.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Watts Point Ecological Preserve, north end of Preserve, south of Big Brook, north of Eddies Cove. – Lat. 51° 27' 40" N, Long. 56° 15' 31" W – Coastal (Cambrian) limestone/dolostone barren with low heathland along beach. – On organic matter in heath community.

James C. Lendemer **#10691** & Andy Moroz 17.August.2007

293. *Opegrapha* sp.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Watts Point Ecological Preserve, north end of Preserve, south of Big Brook, north of Eddies Cove. – Lat. 51° 27' 40" N, Long. 56° 15' 31" W – Coastal (Cambrian) limestone/dolostone barren with low heathland along beach. – On limestone.

James C. Lendemer **#10756** & Andy Moroz 17.August.2007

294. *Megalaria beechingii* Lendemer
Det. J.C. Lendemer, 2007

UNITED STATES OF AMERICA. GEORGIA. TOWNS COUNTY.: Southern Nantahala Wilderness, Chattahoochee National Forest, Hightower Gap to Rich Knob, Hightower Bald Quad. – elev. 3500-4100 ft. – Lat. 35° 05' 08" N, Long. 83° 37' 31" W – Mixed hardwood forest (*Acer, Betula, Carya, Quercus*) with boulders and massive rock overhangs. – On boulder.

James C. Lendemer *et al.* **#10949** 11.November.2007
w/ Sean Q. Beeching & Malcolm Hodges

295. *Tremolecia atrata* (Ach.) Hertel
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Coast north of Raleigh and south of Cape Onion, north of Ha-Ha Mountain. – ca. Lat. 51° 33' N, Long. 55° 42' W – Coastal cliffs and exposed rocky hilltops (derived from Ordovician lava and ash) surrounded by extensive heathland and boggy depressions. – On rock.

James C. Lendemer **#11084** & Andy Moroz 16.August.2007

296. *Lecidea lapicida* (Ach.) Ach.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Coast north of Raleigh and south of Cape Onion, north of Ha-Ha Mountain. – ca. Lat. 51° 33' N, Long. 55° 42' W – Coastal cliffs and exposed rocky hilltops (derived from Ordovician lava and ash) surrounded by extensive heathland and boggy depressions. – On rock.

James C. Lendemer **#11081** & Andy Moroz 16.August.2007

297. *Protoparmelia badia* (Hoffm.) Hafellner
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Ha-Ha Point (Aunt Mart's Hill), northeast end of town of Raleigh, Ha-Ha Bay. – Lat. 51° 35' 11" N, Long. 55° 42' 06" W – Grassy hill with large boulders ("Melange" of basalt, diabase, gabbro, ultramafic rock, enclosed in shale), cliff exposed to ocean, and heathland above. – On boulders.

James C. Lendemer **#10982** & Andy Moroz 15.August.2007

298. *Lecanora torrida* Vainio
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Cape Norman, west of Wild Bight. – Lat. 51° 37' 09" N, Long. 55° 53' 57" W – Ordovician limestone/dolostone pavement barrens and cliffs exposed to the sea. – On limestone.

James C. Lendemer **#11155** & Andy Moroz 15.August.2007

299. *Xanthoria elegans* (Link) Th. Fr.
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Cape Norman, west of Wild Bight. – Lat. 51° 37' 09" N, Long. 55° 53' 57" W – Ordovician limestone/dolostone pavement barrens and cliffs exposed to the sea. – On pebbles.

James C. Lendemer **#11130** & Andy Moroz 15.August.2007

300. *Acarospora nicolai* de Lesd.

UNITED STATES OF AMERICA. KANSAS. ELLSWORTH COUNTY.: 2 mi S, 0.5 mi W Carneiro, Wildlife Management Area along E side 25th Ave., 2.5 mi S jct with KS Hwy 140. – T15S R06W Sec. 31 SW ¼ - ca. Lat. 38.7018° N, Long. 98.0332° W – W and S-facing outcrops and low bluffs of Dakota Formation sandstone in disturbed upland Smoky Hills mixed-grass prairie on slope just E of Alum Creek. – Locally common on weathered, iron-rich sandstone outcrops and boulders.

Caleb A. Morse **#16136** & Katherine Logan 27.October.2007

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